

ARTICULATING THE INTUITIVE: MECHANISMS FOR ENTREPRENEURS TO  
COMMUNICATE OPPORTUNITY EVALUATION DECISION POLICIES

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## ACCEPTANCE

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## **ABSTRACT**

Ironically in the development of expertise, as expertise increases, an individual's ability to communicate the knowledge associated with that expertise decreases. This lack of transferability can be beneficial (the knowledge is inimitable by competitors), but it can also be detrimental (the knowledge is not usable by colleagues and other stakeholders). These differences likely arise from different types of causal ambiguity. Ambiguity about the attributes of a specific entrepreneurial opportunity represents a barrier to the transferability of knowledge to competitors (beneficial), while ambiguity about the relationship between a specific opportunity and value creation represents a barrier to the transferability of knowledge to stakeholders (detrimental). To reduce specific opportunity/value creation relationship ambiguity, I focus in this research on mechanisms thought to enhance entrepreneurial decision makers' decision-policy consciousness in opportunity evaluation decisions. In a field experiment, I capture the opportunity evaluation decisions of 127 entrepreneurial decision makers in high potential technology ventures, and introduce a series of experimental manipulations hypothesized to increase the decision-policy consciousness of these individuals. The findings suggest that firm founders have lower decision-policy consciousness than non-firm founders; that codification increases decision-policy consciousness; that in increasing decision-policy consciousness, codification is more efficacious for founders than non-founders; that opportunity desirability, feasibility and environment play a significant role in

opportunity evaluation; and that as a result of specific individual cognitive factors, systematic differences exist across opportunity evaluation decision policies. In addition to the practical implications of these results for new venture founding, they also contribute to both the entrepreneurial cognition literature and the strategic capabilities literature.

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## CHAPTER I: INTRODUCTION

**Question:** How do you go about making a decision?

**Answer:** Well I would like to say that I evaluate the pros and cons but I don't. I just let my intuition tell me what to do. This is not very scientific. Well I do really do the research. I make sure that I have the facts and not any of the crap in between . . . and then one day the light will go on and the decision is made . . . and once I make it, it sticks, I don't usually change my mind. That's a combination of the research and gut. People think that I am compulsive. But I am not. Cause they don't know. Just because I haven't talked about the decision doesn't mean that it hasn't been going on in my head for a long time. (Age 52)

I introduce the above excerpt from a longer interview with an experienced entrepreneur to make three points. The first two are fairly well accepted in the research literature and provide necessary context. First, becoming an expert in a domain means that declarative knowledge—knowledge about facts and things—often morphs into more automatic and intuitive procedural knowledge: knowledge about how to perform various cognitive activities (Mieg, 2001). Thus, as expertise increases, “knowing what” changes into “knowing how.” The process is called proceduralization. Both the research literature (e.g., Crossan, Lane, & White, 1999) and the popular press (e.g., Gladwell, 2005) provide examples of the effects of this process. In entrepreneurship, the proceduralization process is thought to be particularly important because of its potential role in opportunity

identification and evaluation<sup>1</sup> (Busenitz & Barney, 1997; Mitchell, Friga, & Mitchell, 2005).

Second, while individual experts can often recognize their own expertise—albeit often modestly (Kruger & Dunning, 1999)—these experts are not necessarily able to communicate how this expert knowledge operates (Miller & Ireland, 2005). As Gordon (1992) suggested,

By definition procedural knowledge cannot be directly verbalized. It is therefore counterproductive to ask an expert how he or she made a decision or solved a problem. The best that the expert can do is verbalize the thoughts that came to working memory as a product of the procedures and use declarative knowledge to conjecture what those procedures must have been (1992: 110).

The experience of the entrepreneur quoted previously, seen by others as compulsive because of her inability to communicate the reasons for her decision, is consistent with this second point.

The third point is not as well developed, and is therefore the focus of this research. It is that the intuitive, procedural knowledge underlying an individual's decision about an entrepreneurial opportunity can be transferred, and that this transferability need not lessen its value. On the surface, it might seem that this point is in opposition to two distinct theoretical positions. On the one hand, the resource-based view suggests that the *non*-transferability of knowledge is beneficial because it increases the scarcity of knowledge resources—which result from unique historical conditions, causal ambiguity, and social complexity—limiting imitation of these resources leading to an increased

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<sup>1</sup> Procedural knowledge is not the same as knowledge about a set of procedures; rather, procedural knowledge consists of the knowledge required to perform a task (e.g., the cognitive task of evaluating an opportunity).

competitive advantage (Barney, 1991; Dierickx & Cool, 1989). On the other hand, there is the notion that causal ambiguity about the value of a specific resource leads to factor immobility (Lippman & Rumelt, 1982), meaning that the resource cannot be shared *within* a firm which represents a problem because it can limit an individual's ability to leverage resources that are critical to gaining competitive advantage (King & Zeithaml, 2001: 76). In this sense, non-transferable intuitive, procedural knowledge is both beneficial (i.e., protecting a knowledge resource) and detrimental (i.e., limiting the usefulness of that knowledge resource) at the same time.

An explanation of how intuitive, procedural knowledge can be both beneficial and detrimental can be found in the work of King and Zeithaml (2001), who proposed (and then tested for) two types of causal ambiguity that are thought to differentially affect performance. The first of these, characteristic ambiguity, or ambiguity about the attributes of a specific competency, is related to scarcity. The second, linkage ambiguity, or ambiguity about the link between competency and competitive advantage, is related to factor immobility. In their study, King and Zeithaml found that characteristic ambiguity is positively related to performance, whereas linkage ambiguity is negatively related to performance. This finding is consistent with the suggestion of Kogut and Kulatilaka that:

Scarcity itself does not determine the value of a competence. It is a necessary but not sufficient condition. Rather, scarcity is interesting if the competence permits a firm to achieve a competitive position in the market place. (2001: 747)

In other words, characteristic ambiguity about a specific competence is beneficial if linkage ambiguity related to that competence does not limit the ability to achieve advantage from the competence.

These results are especially relevant in entrepreneurial environments where ambiguity is likely to be high (Hill & Levenhagen, 1995). Characteristic ambiguity is likely to be high because an entrepreneurial opportunity is thought to involve new combinations of resources (Schumpeter, 1934), the newness of which results in a potential competency with attributes that are likely unknown (at least at the beginning) and therefore ambiguous. Building on this, linkage ambiguity is likely to be high because entrepreneurship also involves locating these new combinations *and* putting them into effect (Baumol, 1968: 65), thereby establishing the link between a potential competency and the advantage that can be gained from that competency.

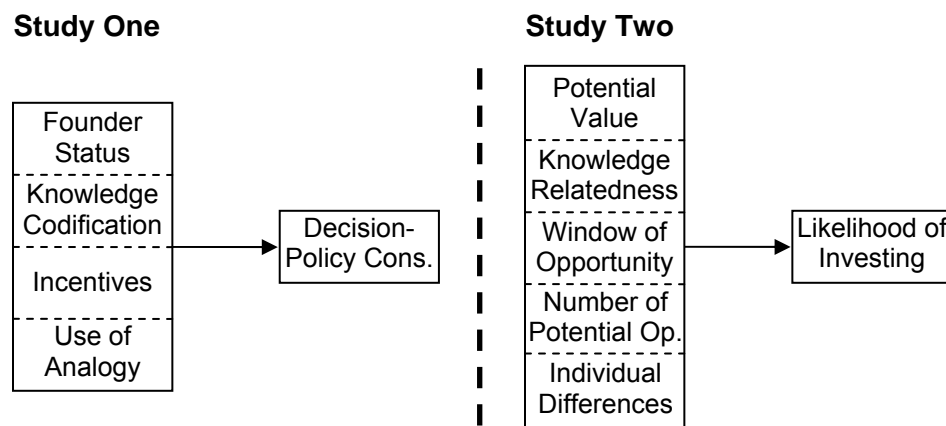
Linking the results of King and Zeithaml (2001) to the three points made previously, high ambiguity in entrepreneurship may be beneficial in some aspects of the process, but not all. So while a high degree of ambiguity about the attributes of an opportunity (characteristic ambiguity) may be beneficial because it can serve to protect the opportunity-based competency from imitation, a high degree of ambiguity of knowledge about the nexus of potential opportunities and the advantage to be gained from these opportunities (linkage ambiguity) may actually be detrimental because it may limit the applicability of the opportunity-based competency within the organization.

In the context of opportunity evaluation decisions, the reduction of linkage ambiguity is manifest in an ability to accurately articulate a decision policy that links opportunities to action, a concomitant of high decision-policy consciousness (or the degree to which an individual is aware of a specific decision policy). This reduction of linkage ambiguity is beneficial because it allows entrepreneurs to articulate how the opportunities that they have recognized will lead to competitive advantage for the individual or firm. For example, an entrepreneur in a corporate venturing setting may recognize a potential opportunity; however, in order to get buy-in from his/her superior, the entrepreneur needs to articulate how the opportunity is linked to competitive advantage and thereby convey why it is beneficial to invest in the specific opportunity.

Thus, consistent with the third point made previously, with this research I address the minimization of the detrimental effects of intuitive decision making in entrepreneurship, while preserving its beneficial effects. Specifically, I investigate the processes whereby an opportunity evaluation decision policy, or the rules an individual uses to make a decision about an opportunity (Priem, 1992), becomes more conscious so that it can be articulated (decreasing linkage ambiguity), and thus transferred to others. Moreover, I argue that decision-policy consciousness of the opportunity evaluation decision is an entrepreneurial resource (Mosakowski, 1998) because it plays a crucial role in the exploitation of profit opportunities (Hill & Levenhagen, 1995; Miller & Ireland, 2005), making it beneficial to new enterprise development at both the individual and firm levels.

Two research questions guide this investigation. First, I seek to understand: *how can entrepreneurial decision makers who rely heavily on intuitive, procedural knowledge in their decision making transfer this knowledge.* Second, I ask: *what is the specific content of the opportunity evaluation decision policy and how does this differ between entrepreneurial decision makers?* Accordingly, this research consists of two related studies—each one addressing a specific research question. As depicted in Figure 1, study one (at the left of the figure) investigates the factors that are hypothesized to increase the decision-

**Figure 1: Description of Studies**



policy consciousness of these opportunity evaluation decisions, thereby decreasing the linkage ambiguity associated with these decisions to result in an entrepreneurial resource. Study two (at the right of the figure) examines the content of the opportunity evaluation decision policy as it relates to entrepreneurial action.

I proceed as follows. In Chapter 2, I utilize insights from the expert performance and expert information processing literatures to suggest a paradox related to entrepreneurial expertise and decision-policy consciousness and then



draw on the strategic capabilities and organization learning literatures to propose a model which represents a potential resolution of this paradox. This model leads to a series of hypotheses related to decreasing entrepreneurial decision makers' linkage ambiguity through increasing decision-policy consciousness (study one). In Chapter 3, I refer to the entrepreneurial cognition and investment under uncertainty literatures to derive a series of hypotheses<sup>2</sup> that describe an entrepreneurial decision maker's opportunity evaluation decision policy (study two). In Chapter 4, I discuss the sample, the measures, the manipulations and the analytical techniques that I use to test the hypotheses. Chapter 5 contains a report of the results. And in Chapter 6, I discuss the implications of the results for both research and practice.

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<sup>2</sup> Because of the interrelated nature of both studies, the hypotheses of the second study build on the first and are numbered consecutively from six to nine.

## **CHAPTER II: DECISION-POLICY CONSCIOUSNESS – STUDY ONE**

This chapter contains three main sections. As background, within the first section, I introduce a paradox suggested by the expert performance and expert information processing literatures relating to expertise and knowledge. In the second section, I review the literature that concerns declarative and procedural knowledge and introduce the concept of decision-policy consciousness, complementing this review of the memory and consciousness literature. In the third section, I then review the strategic capabilities and organization learning literatures which inform how intuitive, procedural knowledge can be made more articulable, and I present a series of testable hypotheses related to increasing decision-policy consciousness.

### **Expertise, Intuition and Ambiguity**

Within the expert performance and expert information processing literatures, a considerable amount of attention is devoted to differences between expert and novice knowledge structures (Glaser, 1984), which allow experts to perform at higher levels (Ericsson & Charness, 1994). In previous research an expert has been defined as “someone with a large knowledge base in a particular context” (Lord & Maher, 1990: 13). While novices (who rely on conscious, deliberate, and explicit thought) are easily able to express their knowledge, the process whereby an individual becomes an expert—indicative of the

proceduralization process—renders experts' knowledge less expressible. As Crossan, Lane, and White suggested in their discussion of expert intuition:

[Something] seems to happen on the way to expertise. What once required conscious, deliberate, and explicit thought no longer does. What once would have taken much deliberation and planning becomes the obvious thing to do (1999: 526).

Such is the case with entrepreneurial intuition. As Mitchell, Friga and Mitchell (2005) noted in their article on entrepreneurial intuition:

Intuition is . . . a dynamic process that initially (as it is developing) involves an explicit awareness of the coming-to-consciousness process, and which is subsequently experienced as “having a hunch” or “just knowing” something is an opportunity (2005: 666).

Again, expertise is the primary mechanism underlying this dynamism in entrepreneurial intuition. Specifically, when expertise increases “the relevant functional level of consciousness of that individual decreases” (2005: 665). In this sense, entrepreneurial intuition can be thought of as: *the proceduralized expert knowledge employed in decisions to pursue entrepreneurial opportunities*.

As expertise in entrepreneurially-relevant domains increases, so too does intuition (Crossan et al., 1999; Gordon, 1992): knowledge based in this expertise becomes proceduralized, and as a result becomes harder to communicate. As acknowledged by Gordon,

People becoming competent in a given domain move away from the use of symbolic or declarative knowledge and toward a reliance on perceptual, nonverbalizable procedural knowledge (1992: 101).

Thus, those individuals who are most qualified to act in a given situation are the least able to accurately describe why they take such actions. And those individuals who are least qualified to act in a given situation are the most able to

accurately describe why they take such actions. Intuition is, in this sense, manifested through a negative relationship between the expertise associated with a decision policy and decision-policy consciousness. In other words, an expert will likely have low decision-policy consciousness about their decisions related to that expertise.

In entrepreneurship, the relationship between founder status and entrepreneurial expertise is particularly salient with respect to decision-policy consciousness. Specifically, the founder of a firm arguably possesses a unique knowledge or expertise of the firm not possessed by others, particularly in connection with the opportunities upon which the firm was founded. Such a view is consistent with suggestions that knowledge asymmetries across a population (Hayek, 1945) play a crucial role in the recognition of opportunities by specific individuals within that population (Shane, 2000). Founders have knowledge that others do not. They possess the unique knowledge that allows them to recognize the opportunity, which serves as the foundation of the new firm. Such notions of unique knowledge are also important in explanations of insight and intuition (Richman, Gobet, Staszewski, & Simon, 1996). The knowledge and expertise (e.g., about a firm) developed over time and the result of experience and practice (Mieg, 2001; Richman et al., 1996) can result in recognition of a solution to a problem and is “usually accompanied by an inability of the solver to explain how the solution was found” (Richman et al., 1996: 180). In other words, a founder’s expertise vis-à-vis entrepreneurial opportunities, is proceduralized. Because

proceduralization is thought to result in lower decision-policy consciousness, it is expected that,

*Hypothesis 1: Firm founders will have lower decision-policy consciousness than non-firm founders.*

This suggests a paradox associated with decision-policy consciousness in entrepreneurship: it is likely to be lowest when, because it is based in expertise, it might be of most use to others. Said differently, causal ambiguity about a decision policy is highest when the underlying value of a decision policy is also high. And while there are times when it is good that causal ambiguity about a decision policy is high, this nonetheless presents a potential problem for entrepreneurs making decisions about opportunities. As is explained in the introduction, causal ambiguity can have differential effects on performance. While ambiguity about the characteristics of an opportunity is positive because it can prevent imitation of the opportunity by others, ambiguity about linkages between the opportunity and performance can be detrimental because it may limit the advantage that can be gained from the opportunity (King & Zeithaml, 2001). Thus, while decision-policy consciousness of the characteristics of a specific opportunity conveys the most advantage when it is low, decision-policy consciousness of how an opportunity is linked to competitive advantage is of the most advantage when it is high. When decision-policy consciousness about a linkage between an opportunity and the advantage to be gained from that opportunity is high, the entrepreneurial decision maker can articulate knowledge

about these links such that others are able to understand and benefit from this knowledge (Alavi & Leidner, 2001).

Miller and Ireland (2005) illustrated this point with reference to the 1949 Mann Gulch fire disaster (Weick, 1993), a true story about a smoke-jumping crew that became trapped in a gulch after the fire they were fighting moved from one side of the gulch to the other. Seeing this, the group's leader, Wagner Dodge, recognized the peril of the situation. His first response was to suggest that the men try to work their way up the side of the gulch. However, because the fire was spreading more quickly than the men were moving, Dodge changed strategies.

As Miller and Ireland related:

Rather than continue to try to move away from the fire, now advancing through the tall grasses at approximately 600 feet per minute with 30-foot high flames, Dodge told his crew to drop their tools and join him in an area he had just set on fire. His tactic of burning grasses to reduce combustible fuel, and lying in the burned area while the primary fire passed, was not part of fire training at the time, nor had Dodge had any prior experience with it. Dodge needed to take a risk, create variance from plan, and experiment with a new direction. His hunch, based on past experience with fire but not a straightforward replay of past learning, proved wise (Miller & Ireland, 2005: 23).

Miller and Ireland noted that because Dodge was not able to explain the thinking behind his decision to his crew, the crew decided not to heed his counsel.

Rather, they continued to the top of the ridge and the majority of them did not make it (while Dodge did survive). Miller and Ireland drew a parallel to more common circumstances in which an individual tries to "sell a hunch" to others, without being able to communicate the reasons the hunch makes sense. This often results in a lack of others' commitment to the hunch, at least in the short run (2005: 23).

Procedural knowledge is frequently difficult to communicate (Cohen & Bacdayan, 1994). As the previous example shows, however, for intuitive, procedural knowledge to be fully utilized it paradoxically often *must* be transferable through the reduction of underlying ambiguity about the knowledge. Yet while such transferability is difficult, the strategic capabilities and organization learning literatures nonetheless hint at ways that an individual's ambiguity can be reduced such that this knowledge might nevertheless be elicited, resulting in high decision-policy consciousness. For example Schön (1983; 1987) suggested that reflection on a specific action can facilitate a better description of knowledge that is difficult to communicate. The process of knowledge codification (Zander & Kogut, 1995) is thought to facilitate such reflection (Zollo & Winter, 2002). Nonaka (1994) also suggested anecdotal evidence that use of analogy aids in the communication of hard-to-communicate knowledge. This is important because to the extent that intuitive, procedural knowledge about an opportunity can be communicated, it represents a resource that an entrepreneurial decision maker can offer to others. Moreover, articulable knowledge represents a possible capability for a firm because of its potential to become an organizational routine (Zollo & Winter, 2002). And once understood, the processes whereby intuitive procedural knowledge is made transferable also represent a potential dynamic capability for a firm (Winter, 2003) because skill at transferability processes can be used to develop and adapt other strategic capabilities and routines (Zollo & Winter, 2002).

Within this chapter I therefore investigate possible methods of increasing the decision-policy consciousness of entrepreneurial decision makers so that intuitive procedural knowledge can be articulated and the entrepreneurial decision makers who possess such knowledge can use it as a resource that is available to themselves and others. I do so in the context of the opportunity evaluation decision. I have chosen this decision because of the increasingly prominent role that opportunity identification plays in entrepreneurship research (Mitchell et al., 2005; Sarasvathy, Dew, Velamuri, & Venkataraman, 2003; Shane & Venkataraman, 2000; Venkataraman, 1997). And in particular, as the experience of the previously-quoted entrepreneur suggests, the decision to pursue a specific opportunity is a decision context that is often not understood by key stakeholders (e.g., investors, family, friends, etc.), and thus represents a fruitful context in which higher decision-policy consciousness may result in better utilization of an entrepreneurial decision maker's time, money and effort.

### **Knowledge and Decision-Policy Consciousness**

***Procedural and Declarative knowledge.*** In 1949, Ryle introduced the epistemological notion that *know how* is distinct from *know that*.<sup>3</sup> While the idea that there are different types or dimensions of knowledge is now reasonably well accepted in the research literature (e.g., Alavi & Leidner, 2001), there is, nonetheless, debate about how different types of knowledge should be conceptualized. For instance, while some suggest that the various types of knowledge (e.g., procedural, declarative, etc.) are distinct and coequal (Cook & Brown, 1999), others see “formistic thinking” about knowledge—the classification

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<sup>3</sup> To which others have added *know why*, *know when* and *know with* (Alavi & Leidner, 2001).



of knowledge into distinct forms or typologies—as fundamentally limiting (Tsoukas, 1996).

In this study I view typologies to be beneficial to scientific theory.<sup>4</sup> I specifically refer to two types of knowledge: declarative knowledge and procedural knowledge, both of which are two parts of a larger whole. Avoiding an epistemological debate about the nature of knowledge, I follow traditional epistemology and view knowledge as a kind of justified belief (Alavi & Leidner, 2001; Nonaka, 1994). In this view, knowledge is seen “as a dynamic human process of justifying personal beliefs toward the ‘truth’” (Nonaka & Takeuchi, 1995: 58). Accordingly, declarative knowledge is a justified belief about facts and things (e.g., knowledge that Paris is the capitol of France); and procedural knowledge is a justified belief about how to perform various cognitive activities<sup>5</sup> (e.g., knowledge of how to read) (Mieg, 2001). While possibly not self-evident, the notion of justified belief as applying to procedural knowledge is rooted in the idea that procedural knowledge is “justified” through the initiation of the procedures that compose procedural knowledge (Gordon, 1992).

As is evidenced by its juxtaposition with declarative knowledge, and as is alluded to in previous paragraphs, procedural knowledge based on expertise in a specific domain is difficult to articulate. This quality of procedural knowledge varies on a continuum: for instance, articulating procedural knowledge relating to

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<sup>4</sup> This is consistent with Stinchcombe (1968: 47) who suggested that typologies have two fundamentally different roles in scientific theory. The first, and primary, function of typologies is to simplify scientific theory. A secondary function of typologies is that they provide a simple way to present interaction effects. The typology used within this study (i.e., declarative vs. procedural knowledge) performs the first of these functions.

<sup>5</sup> Although a great deal of research has been done on procedural knowledge in the domain of motor skills, definitions of procedural knowledge extend beyond motor skills alone (Wallis, 2004), also including cognitive skills and procedures.

an ability to read, while difficult, is more easily done than articulating procedural knowledge related to solving a complex problem. As the previous discussion about intuition denotes, procedural knowledge related to opportunity identification tends toward the difficult-to-articulate end of the spectrum. It is for this reason that I frequently refer to such procedural knowledge as intuitive, procedural knowledge. Of course, this is not to say that it cannot be articulated; but rather, it is simply difficult to articulate. The purpose of this research is to examine the mechanisms that facilitate such articulation.

In the management literature, declarative and procedural knowledge are often considered to be related to explicit knowledge, which is easily communicated, codified and shared, and tacit knowledge, which is completely unavailable to the knower, respectively. For instance, Cohen and Bacdayan (1994) pointed out that one property of procedural knowledge is that it is less explicitly accessible than declarative knowledge. Thus, while not synonymous with tacit knowledge, procedural knowledge and tacit knowledge share a similar quality (i.e., both are difficult to articulate). As such, I refer to previous research on tacit knowledge to inform this study of procedural knowledge.

While research concerning explicit and tacit knowledge in the management literature most frequently addresses knowledge at the level of the organization, most researchers studying organizational knowledge also recognize that such knowledge begins with individuals (e.g., Kogut & Zander, 1992; March, 1991; Nonaka, 1994; Nonaka & Takeuchi, 1995). A notable example of this is theory developed by Nonaka, who placed the individual as “the

prime mover in the process of organizational knowledge creation” (1994: 21) and recognized that the enlargement of an individual’s knowledge is core to the knowledge creation process. It is for this reason that insights provided by Nonaka (1994), as well as those of other organization learning researchers, may inform the processes whereby hard-to-communicate knowledge is made more articulable at the individual level of analysis.

But because knowledge is personalized, it often must be capable of being expressed to others in an interpretable manner for it to be useful to them (Alavi & Leidner, 2001: 110), such as when others are hesitant to commit resources to a specific opportunity until the entrepreneur articulates the reasoning behind his/her decision. When knowledge is declarative in nature, its interpretable expression to others is easily achieved. But when knowledge is of a procedural nature, this is not as easy (Cohen & Bacdayan, 1994; Gordon, 1992; Mieg, 2001).

Previous research in entrepreneurship contains examples where intuitive, procedural knowledge is not accessible to be communicated. For instance a number of studies have shown that venture capitalists are unable to accurately communicate how they make decisions (Shepherd, 1999b; Zacharakis & Meyer, 1998) and that such venture capitalists frequently overstate the least important decision criteria and understate the most important criteria vis-à-vis their actual decision policies (Shepherd, 1999b: 83). This phenomenon in entrepreneurship research is consistent with other research in social judgment theory which suggests that people’s stated knowledge about their own decisions is often an

inaccurate representation of their actual decisions (Priem, 1992; Priem & Harrison, 1994). Argyris and Schön (1974) linked such disparities to differences between “espoused” and “in-use” theory.

Espoused theory is theory “to which [an individual] gives allegiance, and which, upon request, communicates to others” (Argyris & Schön, 1974: 7). In this regard, espoused theory is a type of declarative knowledge possessed by an individual about his/her actions. In-use theory, on the other hand, is the theory “that actually governs [an individual’s] actions” (1974: 7). To the extent that in-use theory governs *actions about performing various cognitive activities*, it is a kind of procedural knowledge which is of interest to this study. Because I am interested in investigating decision making, I use the terms espoused decision policy and in-use decision policy to refer to different types of knowledge about decision making. This approach fits with the suggestion by Argyris and Schön that espoused and in-use theories should include knowledge about behavior in “every domain of human activity” (1974: 7).

In speaking of the relationship between espoused and in-use theory, Argyris and Schön noted that in-use theories “may or may not be compatible with [an individual’s] espoused theory . . . [and] the individual may or may not be aware of the incompatibility of the two theories” (1974: 7). This finding—that people’s espoused knowledge about their own decisions is often inaccurate—represents a significant dilemma for the application of Nonaka’s (1994) knowledge creation framework to decision making. Because the communication of tacit knowledge anchors one end of a proposed “spiral of organizational

knowledge creation” (Nonaka, 1994: 20), errors in communicated knowledge may only be magnified as the knowledge creation process unfolds. Similar outcomes might be expected in other organizational knowledge frameworks (e.g., Kim, 1998).

Within this study I therefore evaluate the decision-policy consciousness of procedural knowledge related to decisions about entrepreneurial opportunities, because in entrepreneurship, the ability to communicate the reasons for a decision to pursue a specific opportunity or to further explore its feasibility is often critical in gaining the support of critical resource providers (Miller & Ireland, 2005: 13-14).

***Decision-Policy Consciousness.*** The extent to which individuals are aware of their in-use decision policy is their decision-policy consciousness. Prior to providing a more precise definition of decision-policy consciousness, however, it is necessary to put the term *consciousness* in context. In psychology research, the consciousness construct is one of the more difficult terms to define (Baars, 1992; Carlson, 1992; Schacter, 1989). Thus, following Schacter (1989), rather than defining consciousness, I describe uses of the term. I offer two. The first use of the consciousness term is the “deliberate or intentional initiation of information retrieval” (Schacter, 1989: 373). The second use of the term is consciousness as “phenomenal awareness” (Schacter, 1989: 356).

Both of these related, but distinct, uses of the consciousness term inform this discussion of decision-policy consciousness in the sense that an understanding of *both* can clarify processes that result in the articulation of an

individual's in-use decision policy. Consciousness as the deliberate or intentional initiation of information retrieval is directed by an executive cognitive system, which mediates and organizes information flow, guides and organizes information retrieval (Gordon, 1992: 108), and most closely reflects the cognitive system that governs individuals' purposeful retrieval of their espoused decision policy. Consciousness as phenomenal awareness is not explicitly directed by an executive cognitive system, but rather refers to "the running span of subjective experience" (Dimond, 1976: 377; Schacter, 1989: 356). This second use of the consciousness term is indicative of the proposed processes whereby an individual begins to consciously understand their in-use decision policies, which will be discussed in greater detail in the next section.

With an understanding of the importance of espoused and in-use decision policies as a background and with use of the consciousness notion put into context, it is now possible to define decision-policy consciousness. This definition draws on notions of congruence (Argyris & Schön, 1974), or the difference between an individual's espoused and in-use decision policies. Decision-policy consciousness is therefore defined for research purposes to be: *the degree of congruence between the declarative knowledge about a specific decision policy (the espoused decision policy) and the procedural knowledge that directs the actual decision (the in-use decision policy)*. Accordingly, individuals with high decision-policy consciousness have a better understanding of their intuitive, procedural knowledge than those with low decision-policy consciousness, and

are thus able to better express this knowledge to others. In this sense, decision-policy consciousness can be viewed as a potential resource.<sup>6</sup>

Returning to Miller and Ireland (2005), when an individual tries to “sell a hunch” to others without being able to communicate the reasons the hunch makes sense, the result is often a lack of commitment from others. Such is often the case in an entrepreneurial environment, which is frequently characterized by information asymmetries (Hayek, 1945) between economic actors. While such asymmetries often lead to new opportunities, they can present challenges in communicating these new opportunities. In the next section, I discuss the ways in which an individual’s intuitive, proceduralized, tacit, in-use theories might be elicited (Argyris & Schön, 1974).

### **Increasing Decision-Policy Consciousness**

The processes whereby the decision-policy consciousness of entrepreneurial decision makers can be increased are of particular importance to this study. Research on strategic capabilities, which investigates how knowledge can be made available for wider and more productive use within the organization (e.g., Zander & Kogut, 1995; Zollo & Winter, 2002), offers insight into processes that facilitate this productive spread of knowledge within an organization.

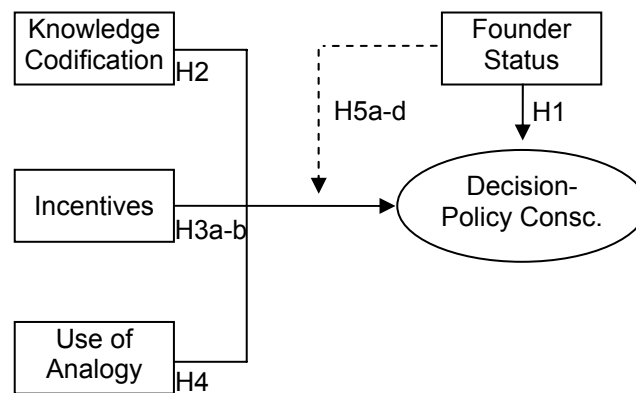
Organization learning research, which examines the ways whereby knowledge is created and transferred within the organization (e.g., Nonaka, 1994; Nonaka &

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<sup>6</sup> Argyris and Schön (1974) made a valid point when speaking of the more general notions of espoused theory and in-use theory. They suggested that there is no particular virtue in a high degree of congruence alone; this assertion is due to the possibility of having congruence of ineffective theory. Within this study, the focus is communicating procedural knowledge, whether or not this knowledge is effective is outside the boundaries of this study; however, inasmuch as *expertise* is at the heart of procedural knowledge, a degree of effectiveness is taken for granted.

Takeuchi, 1995), can also inform discussions about how individual knowledge can be made available to others. Within this section, I utilize insights provided by these literatures to propose a model that suggests ways in which entrepreneurial decision makers can increase decision-policy consciousness of their opportunity evaluation decisions. As Figure 2 depicts, the decision-policy consciousness of the opportunity evaluation decision is thought to be affected by founder status (previously discussed), knowledge codification, the presence of incentives and use of analogy, to which I now direct attention.

**Figure 2: Study One Model**

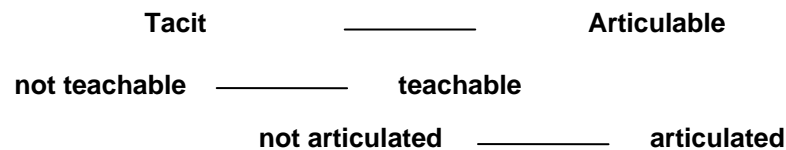


**Knowledge Codification.** In their more general work on evolutionary economics, Nelson and Winter (1982) put forth the notion that much of the operational knowledge underlying organizational routines is tacit. At the individual level, such knowledge is similar to procedural knowledge, as the possessor “is not fully aware of the details of the performance and finds it difficult or impossible to articulate a full account of those details” (1982: 73). It should be noted that the tacitness of knowledge is not absolute, but is rather a matter of degree (Winter,



1987). In discussing knowledge as an asset, Winter (1987) presented a taxonomy for understanding the strategic importance of a specific piece of knowledge that is useful for understanding tacit knowledge. His first dimension, ranging from highly tacit knowledge to fully articulable knowledge (as depicted in Figure 3) is quite telling. Note that the first sub-dimension (not teachable-teachable) does not perfectly overlap the tacit-articulable dimension, nor does it perfectly overlap the not articulated-articulated sub-dimension. This suggests that even tacit knowledge might be taught. But if so, how?

**Figure 3: Tacit-Articulable Knowledge Dimensions**



Source: Winter (1987)

Nonaka suggested four modes of explicit- and/or tacit-knowledge conversion which have implications for how tacit knowledge is taught (1994: 19). The first and the last of these are particularly relevant to questions of making tacit knowledge teachable. The first mode of organizational knowledge conversion, socialization, refers to the conversion of tacit knowledge possessed by one individual into tacit knowledge possessed by another. This mode represents a kind of apprenticeship in which individuals learn tacit knowledge from others by engaging in the same activities as them. This is highly effective, but quite inefficient. The second mode of knowledge conversion, combination, is not relevant to this discussion because it only comprises explicit, not tacit knowledge;

nonetheless it is important to note: it involves the conversion of an individual's explicit knowledge into new explicit knowledge. The third mode of knowledge conversion, internalization, is similar to the proceduralization process described previously and is most like traditional views of learning (Crossan et al., 1999; Gordon, 1992). It involves the conversion of an individual's explicit knowledge into tacit knowledge. The last mode of knowledge conversion, externalization, refers to the conversion of an individual's tacit knowledge into explicit knowledge. It is this process that is most relevant to this study because it is this type of conversion that is involved in the transferring of intuitive, procedural knowledge.

Externalization occurs through dialogue, which facilitates the process whereby tacit "field specific" perspectives are converted into explicit concepts by activating externalization at individual levels (Nonaka, 1994: 25). In like manner, Zollo and Winter (2002) proposed that tacit knowledge can be articulated through collective discussions, debriefing sessions and performance evaluation processes. They suggested that:

By sharing their individual experiences and comparing their opinions with those of their colleagues, organization members can achieve an improved level of understanding of the causal mechanisms intervening between the actions required to execute a certain task and the performance outcomes produced (2002: 341-342).

Taking this a step further, these authors suggested that knowledge codification can result in an even greater understanding of tacit knowledge than can be achieved through articulation alone. "Through the writing process, one is forced to expose the logical steps of one's arguments, to unearth hidden assumptions, and to make the causal linkages explicit" (Zollo & Winter, 2002: 342). Indeed,

knowledge codification efforts require that explicit conclusions be drawn about experience, which articulation alone does not do (2002: 349).

The extent to which knowledge can be codified refers to whether or not that knowledge can be structured into identifiable rules and relationships that are easily articulable (Kogut & Zander, 1992). “Codifiability is a question of the degree that there exists an implied theory by which to identify and symbolically represent knowledge” (1992: 387). Procedural knowledge about a specific decision is codifiable insofar as it is possible to derive an in-use decision policy from a decision maker (Kogut & Zander, 1992). Within this study, I define knowledge codification to be: *the process of converting procedural knowledge into identifiable rules and relationships about a specific decision policy which are then recorded such that they can be communicated* (Cowan & Foray, 1997; Kogut & Zander, 1992). Because increases in decision-policy consciousness can facilitate gaining commitment from important others, knowledge codification is thought to be important to entrepreneurial decision makers. Additionally, knowledge codification is important because it can, by facilitating both the generation and adaptation of operating routines, result in the creation of dynamic capabilities (Zollo & Winter, 2002), which are considered important to wealth creation (Teece, Pisano, & Shuen, 1997).

The knowledge codification process is thought to consist of three elements (Cowan, 2001; Cowan & Foray, 1997) that may help to increase decision-policy consciousness of opportunity evaluation decisions, thereby reducing linkage ambiguity. First, knowledge codification begins with the development of a model

of the knowledge to be codified, resulting in the identifiable rules and relationships that are easily articulable (Kogut & Zander, 1992). Second, knowledge codification also frequently requires the development of language that can be used to describe the model. Third, knowledge codification culminates in the writing of the model, which (as was noted) can reveal hidden assumptions and make causal linkages explicit (Zollo & Winter, 2002: 342). Based on these elements,

*Hypothesis 2: Entrepreneurial decision makers who engage in knowledge codification will possess higher decision-policy consciousness than entrepreneurial decision makers who do not engage in knowledge codification.*

**Incentive.** In addition to knowledge codification, incentive is thought to affect the articulation of knowledge. As Nelson and Winter suggested:

Incentives, too, clearly matter: when circumstances place a great premium on effective articulation, remarkable things can sometimes be accomplished (1982: 78).

How can circumstance place a premium on effective articulation? Nelson and Winter (1982) give the example of a pilot on the ground who can successfully communicate the knowledge required for a non-pilot to land a small airplane. In this “emergency” circumstance, effective articulation is the difference between life and death. In entrepreneurship, although not as extreme a circumstance, incentives also matter.<sup>7</sup> They are thought to be highly correlated with residual risk—a measure of “the ex post *valuation* of a firm’s overall entrepreneurial capability” (Mosakowski, 1998: 632, emphasis in original)—which is generally

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<sup>7</sup> This is not to say that entrepreneurship cannot be extreme.

borne by the entrepreneur<sup>8</sup> (1998). In entrepreneurial circumstances, effective articulation can bring about commitment from important stakeholders (e.g., resource providers) (Miller & Ireland, 2005) which can mean the difference between the life and death of the firm. As a result, entrepreneurs frequently have a high incentive to increase decision-policy consciousness such that the knowledge behind a specific decision is articulable (referred to as decision communication incentives). Thus,

*Hypothesis 3a: Entrepreneurial decision makers with high decision communication incentives will have higher decision-policy consciousness than entrepreneurial decision makers with low decision communication incentives.*

Regulatory-focus theory further illuminates the role of incentives with respect to decision-policy consciousness. In particular, regulatory-focus theory specifies that an incentive can be framed in terms of either gains/non-gains or losses/non-losses (Shah, Higgins, & Friedman, 1998) to stimulate a different cognitive response. Similar to the hedonic principle, which states that people seek pleasure and avoid pain, regulatory-focus theory also suggests that the cognitive mechanisms that lead them to do so are different (Higgins, 1997). Said differently, the ways to approach or avoid a desired outcome can differ. Higgins noted that:

Regulatory-focus theory proposes that self-regulation to strong ideals versus strong oughts differs in regulatory focus. Ideal self-regulation

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<sup>8</sup> Mosakowski (1998) noted that even in situations where, due to wealth constraints, the entrepreneur does not bear all the risk, “high-powered incentives” (Williamson, 1985) will still link incentives to residual risk.

involves a promotion focus, whereas ought self-regulation involves a prevention focus (1997: 1281-1282).

A promotion focus is related to the achievement of *an ideal*; whereas a prevention focus is related to avoiding *what ought not to be done*. Moreover, regulatory focus can be either chronic or situational:

Regulatory focus theory, then, distinguishes between two kinds of goal attainment that vary in chronic focus: attainment of aspirations and accomplishments (promotion focus) and attainment of responsibilities and safety (prevention focus). According to the theory, momentary situations can also temporarily induce either a promotion or a prevention focus on goal attainment. For example, feedback messages or task instructions can communicate gain–nongain information (promotion focus) or nonloss–loss information (prevention focus) (Förster, Higgins, & Idson, 1998: 1116).

In this research, a situational approach is taken in the sense that regulatory focus is manipulated in terms of the type of decision communication incentives (gain-framed versus non-loss-framed) entrepreneurial decision makers receive.<sup>9</sup> When framed in terms of a gain, an incentive is thought to stimulate a promotion focus; when framed in terms of a non-loss, an incentive is thought to stimulate a prevention focus (Förster et al., 1998).

Two sets of findings in regulatory-focus theory are particularly relevant to study one. First, situationally manipulated regulatory focus has been found to result in differences in behavior related to desired and actual outcomes.

Specifically, when promotion focus ideals are primed, research participants tend to seek matches between desired and actual outcomes; conversely, when

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<sup>9</sup> It is important to note that previous findings suggest that individuals with a chronic promotion focus respond better to incentives framed in terms of gains and non-gains and individuals with a chronic prevention focus respond better to incentives framed in terms of losses and non-losses (Shah, Higgins, & Friedman, 1998). In this study, however, chronic regulatory focus was not matched with situationally manipulated regulatory focus, but was rather controlled for through random assignment to incentive conditions.

prevention focus oughts are primed, research participants tend to avoid mismatches between desired and actual outcomes (Higgins, 1997; Higgins, Roney, Crowe, & Hymes, 1994). This is important because the incentive manipulation in this study places high levels of decision-policy consciousness as the outcome of interest (in effect a match), leading to the expectation that those in the gain-framed promotion-focus condition will behave differently towards the achievement of decision-policy consciousness than those in the non-loss framed prevention-focus condition.

Second, in their testing of differences in promotion-framed and prevention-framed tasks, Crowe and Higgins (1997) found that participants working on a difficult task tend to perform better when primed for promotion focus than those who are primed for prevention focus; and that in an alternative generation task, those individuals primed for promotion focus tend to generate a greater number of alternatives than those individuals primed for prevention focus. Taken with the first set of regulatory-focus findings above, it might be expected, then, that the tendency of participants in a match-seeking promotion-focus condition to outperform those in the mismatch-avoiding prevention-focus condition will lead those in the gain-framed promotion-focus condition to have higher decision-policy consciousness than those in the non-loss framed prevention-focus incentive condition. Therefore,

*Hypothesis 3b: Decision-policy consciousness about opportunity assessment will be higher for individuals whose decision*

*communication incentives are framed in terms of gains than those whose incentives are framed in terms of non-losses.*

As will be discussed in more depth, a manipulation check is included to verify the efficacy of the incentive manipulation on situational regulatory focus.

***Use of Analogy.*** Another way in which tacit knowledge can be made more explicit (suggesting possibilities for increasing an entrepreneurial decision maker's decision-policy consciousness) is through use of metaphor<sup>10</sup> and analogy (Nonaka, 1994). In a general sense, analogy can be defined to be: *similarity in relational structure that applies across domains* (Gentner, 1983; Gentner, Rattermann, & Forbus, 1993). In the management literature, reasoning by analogy has been suggested as a way to define problems characterized by complexity and ambiguity (Duhaime & Schwenk, 1985). We reason by analogy when "we make a decision about something new in our experience by drawing a parallel to something old in our experience" (Sternberg, 1977: 99). This allows us to more easily understand new situations or information (Kedar-Cabelli, 1988) and can help to anchor beliefs when evidence about these beliefs is weak or contradictory (Steinbruner, 1974: 115). In this sense, use of analogical thinking can help individuals articulate knowledge that is otherwise difficult to communicate by linking it to knowledge that is already articulable.

Additionally, analogy plays an important role in learning and knowledge transfer in the sense that people are better able to solve a problem if they have

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<sup>10</sup> Because metaphor can be seen as a type of analogical process (Gentner, 1983; Johnson, 1988), and because "metaphors, similes, and so on are our linguistic vehicles for conveying analogies" (Kedar-Cabelli, 1988: 66), the following discussion of reasoning by analogy refers to the concepts of both metaphor and analogy.



previously solved *similar* problems (Gentner et al., 1993). But while notions of similarity are essential to analogy, similarity does not always imply analogy. That is, not all types of similarity are created equally. As Gentner et al. described:

In *analogy*, only relational predicates—low-order and higher order—are shared. In *literal similarity* (overall similarity), both relational predicates and object-attributes are shared. In *surface matches* (or *mere-appearance matches*), only object-attributes and low-order relations are shared . . . Although these distinctions are continua, not dichotomies, it is nonetheless useful to lay out the dimensions (1993: 527, emphasis in original).

Said differently, the degree of similarity among objects—problems, decisions, situations, etc.—can be based on common structure (analogy), based on common surface features (mere-appearance matches), or based in both structural and surface similarity (literal).

Interestingly, the various types of similarity are of differential value in knowledge transfer depending on which component of knowledge transfer is in use. Similarity-based knowledge transfer is thought to consist of four<sup>11</sup> main components (Gentner et al., 1993; Kedar-Cabelli, 1988). First, knowledge transfer using analogies typically begins with an individual's *retrieval of prior potential* analogies. Second, the individual next engages in a *matching process*, wherein prior knowledge about the base (i.e., the known domain) is matched with the target (i.e., the new domain). Third, the individual then *maps additional inferences* from the base onto the target, effectively finishing the analogy, which is, fourth, subsequently *evaluated for soundness* (validity).

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<sup>11</sup> Two additional learning components can also occur in the knowledge transfer process, although they are not always present. The individual can first, adapt inferences about the base to fit the target, and second, extract the common structure of the analogy for later use (Gentner et al., 1993; Kedar-Cabelli, 1988).

Regarding the idea that different types of similarity have differential effects on the various components of knowledge transfer, Gentner et al. (1993) reported that surface similarity strongly affected analogy retrieval (access) processes, whereas structural similarity weakly affected these processes. Conversely, structural similarity strongly influences evaluations of soundness (validity), while surface similarity had no influence on these evaluations.

These findings have implications for this study. As is previously noted, analogies may be useful mechanisms for making tacit knowledge explicit (Nonaka, 1994). As was described previously, similarity across the different types of analogy is a matter of degree. Thus, because surface similarity plays a role in *accessing* a potential analogy, but not in *assessing the soundness* of the analogy (suggesting possible misfires), analogy based primarily on surface similarity may not increase decision-policy consciousness—the analogy used may simply be irrelevant. However, because structural similarity figures prominently in matching and mapping processes (Gentner & Toupin, 1986), and because structural similarity plays a role in *assessing the soundness* of matching and mapping processes, analogy primarily rooted in structural similarity is likely to increase decision-policy consciousness by linking knowledge that is difficult to articulate to information that is already articulated.

This is particularly important in entrepreneurship, because entrepreneurial phenomena are frequently difficult to define and describe; as a result, analogy is often used instead (Nicholson & Anderson, 2005). When analogy rooted in

structural similarity is used to describe an entrepreneurial decision, descriptions of this decision policy may be more accurate. Hence,

*Hypothesis 4: Entrepreneurial decision makers who use structurally similar analogies to describe their decision policies will possess higher decision-policy consciousness than entrepreneurial decision makers who do not use structurally similar analogies.*

**Interactions among Factors.** Just as founder status is hypothesized to have an impact on decision-policy consciousness, so too might it influence the potential effects of knowledge codification, incentives and use of analogy on decision-policy consciousness. That is, founders are expected to benefit more from knowledge codification, incentives and use of analogy than non-founders because they have been shown to think (Busenitz & Barney, 1997; Forbes, 2005) and perform (Begley, 1995; Begley & Boyd, 1987) differently than their managerial counterparts. In the following paragraphs, I present the rationale and hypotheses for each of these interaction effects.

In their work on strategic decision making, Busenitz and Barney (1997) observed that founders and managers differ in their use of decision-making heuristics. At one end of their decision-making continuum are firm founders, who are more prone to rely on the representativeness heuristic than the managers at the other end of the continuum. The reason given for this effect is that founders operate under conditions of higher uncertainty than managers: where managers can make decision based on historical trends and past performance, founders' decisions are made with little information about historical trends or past

performance (Busenitz & Barney, 1997: 13). These findings are particularly relevant in this study because of what can be understood about the formation of views about firm-related opportunities by firm founders compared to non-founders (who likely fall somewhere in the middle of the founder/manager continuum).

The representativeness heuristic has its roots in the work of Tversky and Kahneman (1971; 1974). They suggested that use of the representativeness heuristic involves decision making based on generalized probabilities. Two of the underlying reasons that they provided for use of this effect are particularly relevant here. First, Tversky and Kahneman suggested that use of the representativeness heuristic is, in part, the result of insensitivity to predictability, which is manifest through inattentiveness to “the reliability of the evidence and to the expected accuracy of the prediction” (1974: 1126). In other words, individuals who rely on the representativeness heuristic do not evaluate the dependability of the information that motivates their decision, but simply assume predictability. A second reason that Tversky and Kahneman gave for use of the representativeness heuristic in decision making was the illusion of validity.

Specifically, they suggested that:

The confidence [people] have in their prediction depends primarily on the degree of representativeness (that is, on the quality of the match between the selected outcome and the input) with little or no regard for the factors that limit predictive accuracy . . . The unwarranted confidence which is produced by a good fit between the predicted outcome and the input information may be called the illusion of validity (1974: 1126).

Said differently, individuals who rely on representativeness do not evaluate the extent to which the information provided is meaningful vis-à-vis the predicted

outcome; rather, they assume a link between information input and predicted outcome.

As previously stated, a central feature of knowledge codification is that of model building: a process that involves the organization of identifiable rules and relationships (Kogut & Zander, 1992) and requires an individual to expose the logical steps of his or her argument, to unearth hidden assumptions, and to make causal linkages explicit (Zollo & Winter, 2002: 342). Thus, in the case of the representativeness heuristic, codification is expected to reveal an individual's assumptions related to insensitivity to predictability and to illusions of validity, thereby resulting in a more accurate and thoughtful assessment of opportunity-related information.

Because of differences in the views about opportunities between founders and non-founders relative to codification, the importance (and resulting efficacy) of codification is expected to differ for both groups. In the case of founders, views about firm-related opportunities form at the birth of a firm where use of codification in the decision to "join" a firm is lower because there is no firm and, as a result, not much information to codify. And as noted previously, it is at this time that uncertainty is highest and assumptions about opportunities ubiquitous, leading founders to rely heavily on the representativeness heuristic in their decision making. Conversely, in the case of non-founders, views about firm-related opportunities form when they decide to join a previously-founded firm, where use of codification in the decision to "join" a firm is higher because of the presence of codifiable information about that firm's existing performance. And

again as noted, at this time uncertainty is less prevalent than during the founding process, leading non-founders to rely less on the representativeness heuristic in their firm-related opportunity decision making. In this sense, non-founders utilize codification in their firm-related opportunity decision making to a greater extent than founders, *ceteris paribus*. Combining this with the expected impact that knowledge codification has on checking the assumptions that underlie use of the representativeness heuristic, it is anticipated that,

*Hypothesis 5a: Decision-policy consciousness about opportunity assessment increases as entrepreneurial decision makers engage in codification of their knowledge, but does so at a faster rate for founders than for non-founders.*

As Mosakowski (1998) observes, the residual risk related to a firm's entrepreneurial capability is generally borne by the entrepreneur. This is especially likely in the case of the founder, since firm founder CEOs have been shown to possess more than twice the equity stake in a firm than non-founder CEOs (Willard, Krueger, & Feeser, 1992). In this way, founders who continue to lead their firms following startup have a greater incentive than non-founders to ensure firm survival. And while both founder and non-founder alike bear a significant share of the risk related to that opportunity (Mosakowski, 1998), the greater stake that the founder has may explain why founders feel a more pronounced pressure to succeed (Begley & Boyd, 1987).

This pressure to succeed is also thought to be impacted by the importance of effective articulation, which in entrepreneurial environments facilitates

commitment from important stakeholders (Miller & Ireland, 2005) and is critical to the success of the firm. It is for this reason that decision communication incentives are expected to be more effective for those that have high a higher stake in a firm. Accordingly, as a result of founders' larger stake in the firm, decision communication incentives should influence founders to a greater degree than non-founders. As such,

*Hypothesis 5b: Decision-policy consciousness about opportunity assessment increases as entrepreneurial decision makers' decision communication incentives increase, but does so at a faster rate for founders than for non-founders.*

In relating regulatory-focus theory to entrepreneurship, Brockner, Higgins and Low (2004) suggested that both promotion and prevention orientations can be beneficial in the entrepreneurial process. They propose that promotion focus is particularly beneficial when creativity is at a premium. Conversely, they suggest that a prevention focus is beneficial when accuracy is needed. Moreover, Brockner, Higgins and Low (2004) referred to previous regulatory-focus research which suggests that the efficacy of promotion or prevention focus can depend on the fit between dispositional and situational factors. In this sense, an individual's perception of the organization and the organizational climate may affect whether a promotion or a prevention focus is more efficacious. Founders may not respond to non-loss framed prevention-focus incentives because they do not consider that the company is going to fail (Cooper, Woo, & Dunkelberg, 1988). Similarly, non-founders may be less inclined to respond to gain-framed

promotion-focus incentives because the venture—which they did not create—may represent a market position that must be protected (Anderson & Tushman, 1990) from loss. Accordingly, founders may respond to gain- and loss-focus incentives differently than non-founders. Thus,

*Hypothesis 5c: Decision-policy consciousness about opportunity assessment increases as entrepreneurial decision makers receive decision communication incentives framed in terms of gains, but does so at a faster rate for founders than for non-founders.*

Founders are also thought to benefit from use of analogy to a greater extent than non-founders. This is because founders and non-founders differ in their experiences related to the founding of a firm. While firm founders are present at the beginning of a firm and as a result experience the entire creation process, non-founders are not present at firm founding and, thus, only observe the firm as founded. In this sense, firm founders possess a greater degree of experience-based expertise (Reuber & Fischer, 1994) than non-founders; and as a result are endowed with expert knowledge that is of a deeper quality (i.e., procedural knowledge) than others with less experience at their firm (Leonard & Swap, 2004).

In her work on differences in analogical transfer for experts and novices, Novick (1988) found that in the case of structurally similar analogies, positive transfer from analogy base to analogy target was more likely for experts than for novices. In this sense, founders with greater experience-based expertise regarding the opportunities related to the firm will likely benefit more from



structurally similar analogies than will non-founders with less experience-based expertise. And because structural similarity is thought to increase decision-policy consciousness through matching processes (Gentner & Toupin, 1986) that link knowledge that is difficult to articulate to information that is already articulated,

*Hypothesis 5d: Decision-policy consciousness about opportunity assessment increases as entrepreneurial decision makers utilize structurally similar analogies to describe their decision policies, but does so at a faster rate for founders than for non-founders.*

I now turn to the opportunity evaluation decision policy in which the preceding hypotheses are tested.

### **CHAPTER III: OPPORTUNITY EVALUATION DECISION – STUDY TWO**

For entrepreneurial decision makers to fully benefit from an opportunity, linkage ambiguity (i.e., ambiguity about how advantage might be gained from the opportunity) may need to be reduced. Within the previous chapter, I have discussed some possible ways in which this can be done (i.e., through knowledge codification, incentives, and use of analogy). The reduction of linkage ambiguity in the context of opportunity evaluation results in an entrepreneurial decision maker's ability to articulate the procedural knowledge that he/she uses in making an opportunity evaluation decision. To investigate opportunity evaluation, I draw on the entrepreneurial cognition and investment under uncertainty literatures, focusing specifically on decisions to act entrepreneurially. Likewise, I employ both the entrepreneurial cognition and investment under uncertainty literatures to understand the opportunity evaluation decision because the characteristics of investments made in an uncertain environment permit explicit focus on distinct elements of the opportunity-pursuing decision. This decision is important because it is the decision that can bridge the gap between decision making in exploration of an opportunity and decision making in exploitation of that opportunity, which are both important to success (March, 1991).

In this chapter, I begin with a discussion of entrepreneurial decision making, and how it relates to opportunity evaluation, followed by a brief review of

the literatures related to entrepreneurial action. I then present factors suggested in the literature to be relevant to entrepreneurial action as investment and introduce hypotheses about the relationships between these factors and entrepreneurial action.

## **Entrepreneurial Decision Making and Entrepreneurial Action**

***Entrepreneurial Decision Making.*** A good deal of research in entrepreneurship has investigated the factors that may lead to differences in decision making between entrepreneurs and non-entrepreneurs. For instance, McClelland (1961) investigated decision making in the context of risk taking by entrepreneurs, finding that high-achieving entrepreneurs were not necessarily high-risk-taking entrepreneurs. Similarly, Brockhaus (1980) found that risk-taking propensity is not a distinguishing difference between entrepreneurs and non-entrepreneurs. More recently, Busenitz and Barney (1997) found that while there may not be differences in the risk-taking propensities between entrepreneurs and their manager counterparts, there is a difference in the heuristics—and resulting biases—that operate in each group's decision making. Taking an expert information processing approach, Mitchell, Smith, Seawright and Morse (2000) considered the effects of entrepreneurial expertise on the venture creation decision and found that three types of expert scripts—arrangement scripts, willingness scripts and ability scripts—are associated with the venture creation decision. But a decision alone is not sufficient. As McMullen and Shepherd (2006) noted:

Entrepreneurship requires one, not just to decide, but to decide *to act* . . . *entrepreneurial action* refers to behavior in response to a judgmental

decision under uncertainty about a possible opportunity for profit. Whether entrepreneurial action occurs, however, depends upon how much one must rely upon his or her judgment, which in turn depends upon the degree of uncertainty experienced in the decision of whether to act (2006: 134, emphasis in original).

Two points are important. First, it is the decision to act that is important in opportunity evaluation. And second, whether or not an entrepreneur decides to act on an entrepreneurial opportunity is affected by the uncertainty surrounding that entrepreneurial opportunity. Utilizing the insights of McMullen and Shepherd, and drawing on the investment under uncertainty literature, I elaborate on this assertion in the following section.

***Entrepreneurial Action.*** Entrepreneurial action can take many forms. In their presentation of a typology of the entrepreneurial opportunity, Dean and McMullen (2002) suggested a number of entrepreneurial actions on entrepreneurial opportunities, each of which is a kind of *reaction* to market failure.

Because mathematical economists have shown that a Pareto efficient outcome is dependent on the validity of the assumptions of competitive equilibrium, departures from these assumptions represent potential market failures. Thus, the primary classes of market failure discussed in the welfare economics literature are derived directly from these assumptions, and include *imperfect information*, *monopoly power*, *public goods*, *externalities*, and *inappropriate government intervention* (2002: F2, emphasis in original).

Thus, entrepreneurial action in the context of market failure can include discovering and exploiting information, destroying monopoly positions, privatizing public goods, creating markets for externalities and eliminating inappropriate government intervention. In each case of entrepreneurial action an investment of money, effort or time is implied. And in each case, entrepreneurial action can

also lead to the creation of additional value through a Pareto improvement or a transaction that can make both parties to the transaction better off without making anyone else worse off (Varian, 2003: 17). In this sense, entrepreneurial action as investment has the potential to create new value that would not otherwise exist. Thus, building on the definition of entrepreneurial action provided by McMullen and Shepherd, I define entrepreneurial action to be: *an investment “in response to a judgmental decision under uncertainty about a possible opportunity for profit”* (2006: 134).

In spite of the importance of research on entrepreneurial action, current thinking about this concept has a relatively short history. In the early 1990's, research in entrepreneurship shifted in focus (e.g., Gartner, 1989). Rather than concentrating on entrepreneurial traits (e.g., Carland, Hoy, Boulton, & Carland, 1984), researchers began to focus more on entrepreneurial behaviors and actions (e.g., Carter, Gartner, & Reynolds, 1996). Rather than looking at who the entrepreneur was, entrepreneurship researchers began to look at what the entrepreneur did. With this shift, researchers in entrepreneurship also began to examine entrepreneurial action in conjunction with cognitive factors related to the entrepreneur (e.g., Shaver & Scott, 1991). As Shaver and Scott argued: “A comprehensive psychological portrait of new venture creation will ultimately have to show how the individual's cognitive representations of the world get translated into action” (1991: 27). In this regard, entrepreneurial action is the result of the

entrepreneur's perceptions of both potential opportunities and factors related to these opportunities.<sup>12</sup>

This view accords with the theory of entrepreneurial action suggested by McMullen and Shepherd (2006), who proposed two stages of entrepreneurial action: opportunity attention and opportunity evaluation. Opportunity attention involves questions of why opportunities are recognized and acted upon *in general* (referred to as *third-person opportunities*). Opportunity evaluation involves questions of why opportunities are recognized and acted upon *by specific individuals* (referred to as *first-person opportunities*). McMullen and Shepherd noted that perceptions of uncertainty have a preventative role in both processes. Perceived uncertainty in the opportunity attention stage can prevent the recognition of the opportunity in general. Similarly, perceived uncertainty in the opportunity evaluation stage prevents action on an opportunity by specific individuals. In other words: "uncertainty prevents action by obfuscating (1) the need or possibility for action, (2) the knowledge of what to do, and (3) whether the potential reward of action is worth the potential cost" (McMullen & Shepherd, 2006: 139).

### **Opportunity Evaluation**

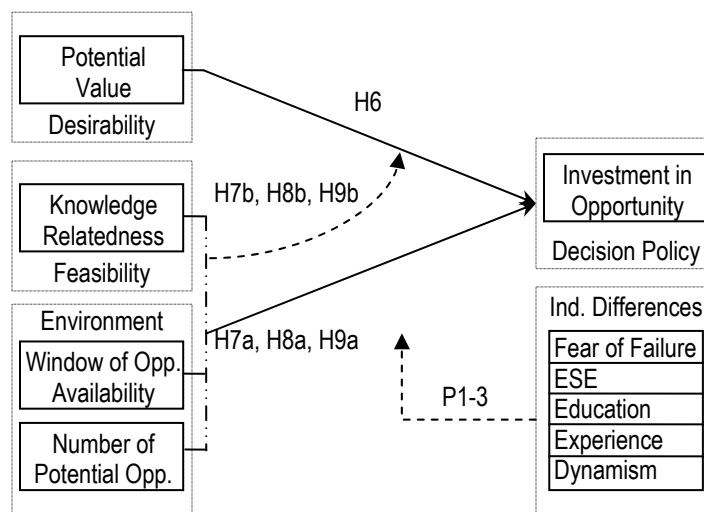
This study focuses on the second stage of entrepreneurial action, opportunity evaluation, because of the low decision-policy consciousness that is frequent in opportunity evaluation decisions. And as is noted in chapter 1, low decision-policy consciousness in the context of opportunity evaluation may

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<sup>12</sup> From the perspective of explaining whether an individual engages in an entrepreneurial action or not, I note that it is unimportant whether these perceptions are objectively accurate since it is the entrepreneur's subjective experience that leads to action (Krueger, 1993).

negatively affect performance because the inability to articulate how advantage might be gained through action on an opportunity can limit the usefulness of the opportunity. Opportunity evaluation begins with the recognition of a third-person opportunity, a result of opportunity attention. As potential entrepreneurs decide to invest in the opportunity, the third-person opportunity becomes a first-person opportunity (McMullen & Shepherd, 2006). It is the decision to move from a third-person opportunity to a first-person opportunity that is described in Figure 4.

**Figure 4: Study Two Model**



Perceptions of desirability and feasibility of the opportunity affect this decision to invest. In opportunity evaluation the decision to invest is also affected by the presence of uncertainty (McMullen & Shepherd, 2006), especially with respect to the nature of the environment. Additionally, individual difference factors are also thought to influence the decision to invest in an entrepreneurial opportunity (e.g., entrepreneurial self-efficacy) and will be investigated in more depth as part of the analysis. In the following section, I complement research on

entrepreneurial action with studies from the investment under uncertainty literature to justify each aspect of the opportunity evaluation decision. To this I turn.

***Potential Value of an Opportunity.*** The desirability of an opportunity is in large part based on the value to be gained from investing in an entrepreneurial opportunity. This value is based on two relevant benchmarks: “(1) the absolute level of economic performance that provides a return for enterprising effort, and (2) the social contribution of the individual's effort” (Venkataraman, 1997: 132). The first of the two benchmarks is determined by subtracting the cost of economic effort from the economic advantage created, to result in either an advantage surplus or an advantage loss (Venkataraman, 1997). In addition to opportunity costs and premiums for risk and uncertainty, the cost of enterprising effort is a lack of liquidity—consisting of money, effort and time, and “only the surplus above this minimum can be counted as the entrepreneurs reward” (1997: 132-133). Accordingly, the potential value of an opportunity is defined to be: *the predicted financial advantage of entrepreneurial action after the predicted expenses (i.e., time, money and effort) incurred in entrepreneurial action have been taken into account.* As Krueger and Brazeal noted, in Ajzen's theory of planned behavior, intentions to act are in part based on perceived desirability (Krueger, 2000; Krueger & Brazeal, 1994). And insofar as a large financial advantage can compensate opportunity seekers for their efforts (Venkataraman, 1997) thereby meeting some threshold of desirability; and insofar as strength of



intentions is thought to be related to action (Kim & Hunter, 1993), potential value is likely to relate to entrepreneurial action on an opportunity. Hence,

*Hypothesis 6: The higher the potential value (desirability) of an opportunity, the more likely an entrepreneurial decision maker is to invest in (act on) that opportunity.*

While self-evident, this hypothesis also plays an important part in other aspects of the opportunity evaluation decision policy, which is explained further in the following sections.

**Knowledge Relatedness.** Opportunity evaluation is also thought to be influenced by entrepreneurs' perceptions of feasibility with respect to a specific opportunity. Perception of feasibility refers to an individual's perception that they have the requisite knowledge to successfully perform a specific behavior (Krueger, 1993). In this sense, perceptions of feasibility are linked to the question of whether the knowledge required to capture (or exploit) an opportunity is related to the knowledge already possessed by the entrepreneur. Thus, it is the relatedness of knowledge required by the opportunity that is important. In this study, knowledge relatedness is defined to be: *the extent to which the knowledge that is perceived as necessary to exploit an opportunity is similar to the knowledge already possessed.* The higher the knowledge relatedness, the more feasible a potentially valuable opportunity seems; and as was the case with desirability, perceived feasibility of an opportunity is linked to the intention to act on that opportunity (Krueger, 2000; Krueger & Brazeal, 1994). Thus,

*Hypothesis 7a: The higher the knowledge relatedness (feasibility) of an opportunity, the more likely an entrepreneurial decision maker is to invest in (act on) that opportunity.*

There is, however, more to the story. In discussing perceived desirability, perceived feasibility and intention to act, Krueger (1993) suggests a non-linear relationship between these factors. This implies that the potential value of an opportunity and the knowledge relatedness of the opportunity may interact in their effect on the decision to invest in an opportunity. When considering opportunities with high potential value, potential entrepreneurs may be more likely to act in situations where the knowledge that they possess is closely related to the knowledge that is thought to be required, than in situations where the knowledge they possess is not related to the knowledge that is perceived as required. The importance of knowledge relatedness is in line with findings that firms who “stick to their knitting” outperform firms who do not (Peters & Waterman, 1982). Thus,

*Hypothesis 7b: The likelihood of investing in (acting on) an opportunity increases with the potential value (desirability) of an opportunity, but does so at a faster rate when knowledge relatedness (feasibility) of the opportunity is high.*

The expected form of the interaction effect between potential value and knowledge relatedness of an opportunity is depicted in figure 5a.

As is depicted in figure 4, hypotheses 8a, 8b, 9a and 9b—concerning the main and moderating roles of window of opportunity and number of potential

opportunities—are related to environmental factors. In the following sections I develop the logic that leads to these hypotheses.

***Window of Opportunity Availability.*** As was previously emphasized, opportunity evaluation decisions occur under conditions of uncertainty, the coping with which is thought to be “the essence of the administrative process” (Thompson, 1967: 159). The notion of uncertainty has been an important topic related to value creation since Knight introduced the notion of “true” uncertainty or uncertainty that is not susceptible to measurement, but that can account for “the peculiar income of the entrepreneur” (1921: 232). In the management literature, uncertainty has generally been defined as the inability of an individual to perceive something accurately (Milliken, 1987: 136).

One of the key insights in the investment under uncertainty literature is that investments in an opportunity can be postponed until uncertainty about the investment is minimized (Dixit & Pindyck, 1994). This is not to say, however, that an opportunity does not expire. While opportunity expiration is often indeterminate, imprecise, and rarely linked to a finite date (Janney & Dess, 2004: 61), the closing of the window of an opportunity—when it does occur—is usually the result of “competitive action or an environmental shift” (McGrath, 1996: 104) within the already uncertain environment. In this study, window of opportunity availability is defined to be: *the length of time that is left for an entrepreneurial decision maker to profitably act on an opportunity*. A narrow window of opportunity availability is indicative of opportunity-related time pressure: decisions about opportunities in such circumstances cannot be delayed without

risking loss of those opportunities. Because deadlines are likely to require more immediate decisions (Moore, 2004a), narrower windows of opportunity availability are likely to result in entrepreneurial action. Accordingly,

*Hypothesis 8a: The narrower the window of opportunity availability (environment), the more likely an entrepreneurial decision maker is to invest in (act on) that opportunity.*

Additionally, as Moore (2004b) noted (in the context of negotiation), individuals with less time available to negotiate have lower demands than those individuals with more time available, leading those with less time to be more prone to negotiate than those with more time. This finding is applicable to the context of action on an entrepreneurial opportunity in that one might expect individuals with narrower windows of opportunity availability to have lower demands of an opportunity than those with more time available. A related finding is reported by Ku, Malhotra and Murnighan, (2005) who found that time pressure can lead to overpayment in auctions; and while opportunity evaluation decisions differ in many respects from auctions, the effect of time pressure on human behavior exhibited in auctions is also expected in opportunity evaluation decisions. Specifically, a tendency for overpayment in an auction (which reduces the overall net-buyer benefit of a purchase (Ghemawat, 1991)) can be viewed as analogous to a reduction of demands in opportunity evaluation decisions (which reduces the overall benefit of an opportunity investment).

Taken together, these findings suggest that as the pressure to decide on an investment increases, the personal requirements for the outcome of that

investment decrease. This is consistent with the findings of Ahituv, Igbaria and Sella (1998) who found that time pressure in decision making frequently impairs performance. In this regard, time pressure in the form of narrow windows of opportunity may have a differential effect on an entrepreneurial decision maker's propensity to invest in high-value versus low-value opportunities. Therefore,

*Hypothesis 8b: The likelihood of investing in (acting on) an opportunity increases with the potential value of an opportunity, but does so at a faster rate when the window of opportunity availability (environment) is narrow.*

The expected form of the interaction effect between potential value of an opportunity and the window of opportunity availability is depicted in figure 5b.

***Number of Potential Opportunities.*** Perceived opportunities do not necessarily exist in isolation. Rather, a recognized third-person opportunity may be one of many perceived opportunities. In this study, I define the number of potential opportunities to be: *the total number of third-person opportunities recognized by a given entrepreneur*. In speaking of opportunities in a real options context, McGrath and Nerkar (2004) observed that firms who possess a portfolio of real options on opportunities (which consists of investments in more than one option at a time) behave differently than those who do not have portfolios of real options. Moreover, they found that the assessment of an option on an opportunity in a portfolio is interdependent with the rest of the portfolio (McGrath & Nerkar, 2004: 17). The same might be true of third-person opportunities: the presence of

multiple third-person opportunities may complicate individual choice about these opportunities.

Moreover, entrepreneurial firms operate under conditions of resource constraints (Aldrich, 1999); and while limited resources have been shown to lead to increases in performance in private firms (George, 2005) (a result of increased creativity in the use of resources (Baker & Nelson, 2003)) such resource constraints can also affect decisions about specific opportunities because the pursuit of one opportunity can tie up resources in entrepreneurial firms such that pursuit of other opportunities may not be possible. Thus, when an entrepreneurial decision maker invests in one opportunity, it may be at the expense of other viable opportunities. Conversely, when there is but one opportunity available, entrepreneurial decision makers in high velocity environments may feel compelled to invest in that opportunity because of their lack of choice simply due to uncertainty surrounding the future. Such action on the part of entrepreneurial decision makers is consistent with previous assertions that uncertain environments (e.g., environments with changing technologies) lead to managerial action (Hitt & Tyler, 1991; Zahra, Neubaum, & Huse, 1997). As a result, a low number of potential opportunities will increase the likelihood of investing in one of these opportunities. Therefore,

*Hypothesis 9a: The fewer the number of potential opportunities available (environment), the more likely an entrepreneurial decision maker is to invest in (act on) that opportunity.*

Eisenhardt reported an interesting finding related to number of potential opportunities. Specifically, she found that the greater the number of alternatives considered, the faster the decision making (1989: 556). This finding is contrary to previous research which found greater numbers of potential opportunities to evaluate might slow decision-making processes (Fredrickson & Mitchell, 1984). Her explanations for this effect were fourfold. First, she suggested that alternatives viewed in isolation are difficult to evaluate (e.g., buying a car after only seeing one). Second, having multiple opportunities reduces escalation-of-commitment problems.

Decision makers who pursue multiple options have a lower psychological stake in any one alternative and thus can quickly shift between options if they receive negative information on any alternative (1989: 558).

Third, she noted that having more than one opportunity can provide a fallback position, meaning that if one alternative fails, there is another alternative in the wings. And fourth, she noted that “the view that multiple alternatives are time-consuming does not distinguish between the number of alternatives and the depth of analysis” (1989: 558).

Taken together, these findings would seem to indicate that the expectations of entrepreneurial decision makers evaluating multiple opportunities may be higher than entrepreneurial decision makers evaluating few opportunities. Moreover, because attention is more focused when there are fewer distractions (Damrad-Frye & Laird, 1989), increases in the potential value of the opportunity may be more salient when the number of potential opportunities is low, than when the number of potential opportunities is high. In

this sense, the number of potential opportunities available may have a differential effect on investment with respect to the potential value of an opportunity.

Accordingly,

*Hypothesis 9b: The likelihood of investing in (acting on) an opportunity increases with potential value of an opportunity, but does so at a faster rate when the number of potential opportunities available (environment) is few.*

The expected form of the interaction effect described in hypothesis 9b is depicted in figure 5c.

**Individual Differences.** As is noted previously, a number of individual differences may affect the opportunity evaluation decision. Within this section I discuss a number of these differences and, through a series of propositions, suggest possible ways in which they may be related to the decision to invest in an opportunity. Specifically, I explore how fear of failure, entrepreneurial self-efficacy and human capital affect the decision to invest.

Numbered among the interesting insights provided to entrepreneurship by the investment under uncertainty literature (real options theory, specifically) is the notion that by waiting to invest, entrepreneurs can *manage the costs* of failure, rather than focus on *avoiding* failure (McGrath, 1999). This insight is particularly interesting because much of the early research in entrepreneurship focused on achieving success (Vesper, 1980) or avoiding failure (Dickinson, 1981). The potential benefits of failure (Sitkin, 1992) were seldom included in early



**Figure 5a-c:  
Interaction  
Effects**

Figure 5a: H7b  
Potential Value\*  
Knowledge  
Relatedness

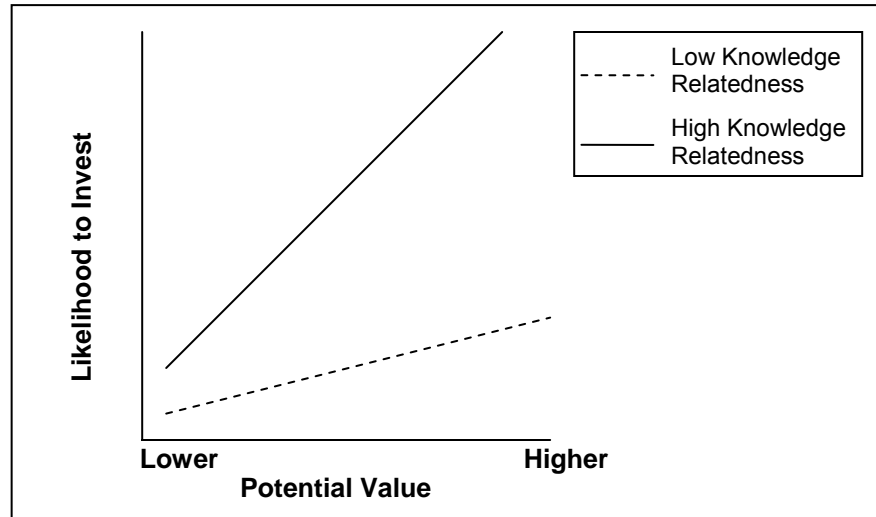


Figure 5b: H8b  
Potential Value\*  
Window of  
Opportunity  
Availability

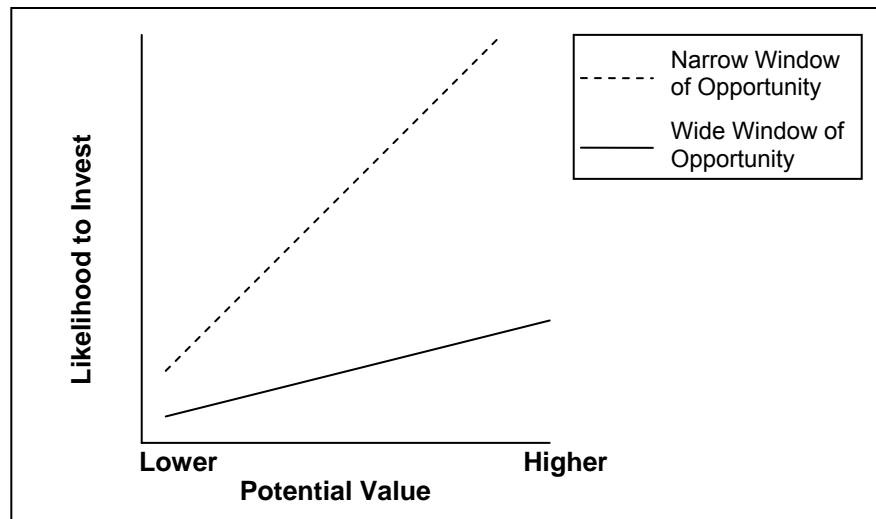
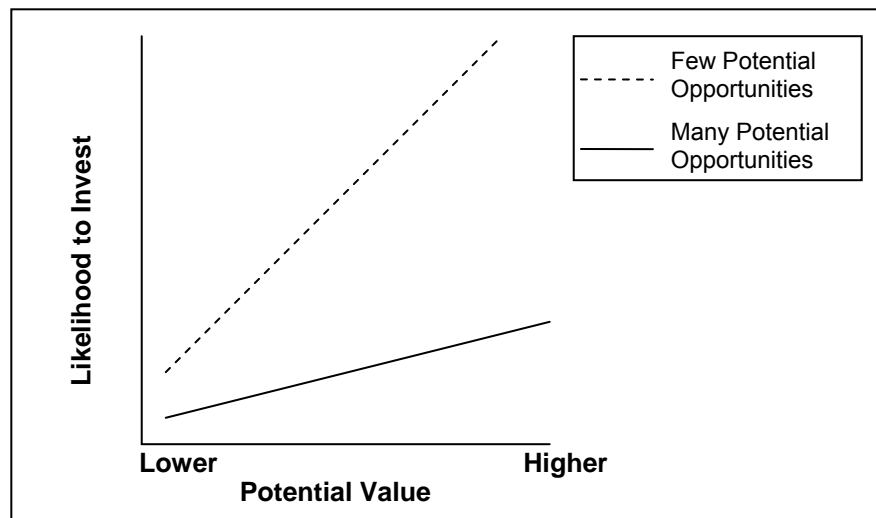


Figure 5c: H9b  
Potential Value\*  
Number of  
Potential  
Opportunities



entrepreneurship discourse.<sup>13</sup> In recent research, however, the tendency to focus solely on the benefits of success and the drawbacks of failure has been replaced with a more equitable treatment of both success (e.g., Miller, 1994) and failure (e.g., McGrath, 1999; Sitkin, 1992).

However, despite this progress toward a more balanced treatment of both success and failure, there still seems to exist a general bias *against* failure and *for* success (McGrath, 1999).<sup>14</sup> When manifest at the individual level, this bias is thought to introduce “errors in learning and interpretation processes,” which paradoxically “often make failure more likely and more expensive than it need to have been” (McGrath, 1999: 16). Thus, this bias *against* failure, which is manifested as failure avoidance or fear of failure, is likely reflected in entrepreneurial decision makers’ opportunity evaluation decisions. Entrepreneurial decision makers who are thus biased against failure may behave in ways that are inconsistent with what theories based on assumptions of rationality may suggest. For instance, they may focus more on factors related to failure (e.g., window of opportunity availability) and less on factors related to upside potential (e.g., potential value of opportunity). Their decision policies may be simpler (e.g., less weight on the interaction terms), or may contain qualitatively different kinds of interactions. Additionally, holding all else constant, entrepreneurial decision makers who are biased against failure may be less likely

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<sup>13</sup> For a notable exception see Stacey (1983).

<sup>14</sup> See Hogarty (1993) and Osborne (1993) for representative examples.

to invest in entrepreneurial opportunities than entrepreneurial decision makers who are not, because investing can lead to failure.<sup>15</sup> Thus,

*Proposition 1: Entrepreneurial decision makers' opportunity evaluation decision policies will differ based on their attitudes about failure.*

The notion of self-efficacy is based on social learning theory (Bandura, 1977) and is defined as an individual's perceived ability to execute some target behavior (Krueger, 2000: 11; Krueger & Brazeal, 1994: 94). In entrepreneurship, self-efficacy has been linked to entrepreneurial intentions and actions (Boyd & Vozikis, 1994). Additionally, Boyd and Vozikis suggest that entrepreneurs who report higher self-efficacy set more challenging goals for themselves than entrepreneurs who have lower self-efficacy (1994). In their study on entrepreneurial self-efficacy, Chen, Green and Crick (1998) note that entrepreneurial self-efficacy is positively related to intentions to start a business, also finding that the entrepreneurial self-efficacy of founders is higher with respect to innovation and risk-taking than it was for non-founders.

Based on these findings, one might expect in the current context that individuals with high degrees of entrepreneurial self-efficacy will be more prone to invest in opportunities than those with low degrees of entrepreneurial self-efficacy. In addition, self-efficacy is closely related to perceptions of feasibility and knowledge relatedness. And whereas knowledge relatedness is a function of the opportunity, self-efficacy is a function of the person and is thought to be

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<sup>15</sup> While a missed opportunity can also be considered a failure in the form of a sin of omission, the focus of this study is on a bias against failure in the form of a sin of commission.

situation specific (Krueger & Brazeal, 1994). Consequently, individuals who have high entrepreneurial self-efficacy might be less likely to view low knowledge relatedness in a particular opportunity situation as problematic. Moreover, because entrepreneurial self-efficacy is not dependent on the characteristics of the opportunity, and because individuals with higher self-efficacy are more likely to take risks (Krueger & Dickson, 1994), entrepreneurial decision makers with high entrepreneurial self-efficacy may be more inclined to invest, *ceteris paribus*, because they simply believe that they can do it. Therefore,

*Proposition 2: Entrepreneurial decision makers' opportunity evaluation decision policies will differ based on their perceived entrepreneurial self-efficacy.*

Human capital is a third factor that is likely to affect an individual's decision to invest in an opportunity. Broadly viewed, human capital includes an individual's ability as well as their acquired skills (Markman & Baron, 2003): the greater the investment in human capital, the greater the return for that investment (Becker, 1975). More precisely defined, human capital is specified as either general or specific (Becker, 1975). General human capital typically refers to an individual's educational experience on the whole, whereas specific human capital refers to an individual's educational experience within a certain firm or industry. In entrepreneurship, human capital has been linked to entry into entrepreneurship (Davidsson & Honig, 2003); general and specific human capital have been linked to firm survival and growth (Cooper, Gimeno-Gascon, & Woo, 1994; Pennings, Lee, & van Witteloostuijn, 1998); and general human capital has

been linked to opportunity portfolio performance of venture capitalists (Dimov & Shepherd, 2005).

Within this study, I follow Dimov and Shepherd (2005) in defining general and specific human capital: general human capital refers to education and specific human capital refers to industry experience. And based on the previously discussed importance of human capital in the entrepreneurial process, it is expected that both general human capital (overall educational experience) and specific human capital (industry experience) will also affect the decision to invest in an opportunity. Thus, it is expected that,

*Proposition 3: Entrepreneurial decision makers' opportunity evaluation decision policies will differ based on their general human capital (educational experience) and specific human capital (industry experience).*

Additional individual level factors are also included in the study, but are not discussed in depth here as they are only to be used as descriptive/control variables in the study. These include environmental dynamism and other demographic information such as age and gender.

In the next chapter, I discuss the methodology used to test the hypotheses related to decision-policy consciousness (Hypotheses 1-5) and the opportunity evaluation decision policy (Hypotheses 6-9).

## CHAPTER IV: METHODS

This chapter has two main sections. In the first section, I discuss the methods used to test the hypotheses in study one; in the second section, I address the methods used to test the hypotheses in study two. I hasten to note that because the testing of the hypotheses related to increasing decision-policy consciousness (study one) is done through a series of manipulations that are carried out *during measurement* of the opportunity evaluation decision policy (study two), there will be some overlap between sections.

### Study One – Decision-Policy Consciousness

**Sample.** The selection of the sample began with a series of focused interviews with four entrepreneurial decision makers, each in a different industry. During these interviews, each entrepreneurial decision maker was asked questions regarding: (1) their approach to entrepreneurial opportunities within their specific industry, (2) their approach towards opportunities in general, (3) the factors that they consider when looking at investing in entrepreneurial opportunities, and (4) their approach to failure (this last question being used to develop/select a measurement instrument that relates to entrepreneurial failure). Appendix A contains the interview guide, which plays an indispensable part of the interview process (Merton & Kendall, 1946).

Based on their responses to the first three questions, it was evident that a sample of high potential technology-related ventures would be appropriate to test

the hypotheses. This is because the fast-changing nature of technology leads decision makers in technology-related industries to report a frequent need to make decisions about new or changing opportunities (Hughes, 1990). Thus, a sample of technology companies was selected from the OneSource CorpTech database. This database is well-known in the information services industry for being a leading provider of information on technology-related companies (Kassel, 1999) and has been extensively used in the management literature as a data source (Gardner, 2005; Kickul & Gundry, 2001; Schilling & Steensma, 2002). Specific benefits of this database are that it includes the name and contact information for the president/CEO/owner of each firm, the number of employees of each firm as well as the founding date for each firm.

Due to the experimental (and consequent face-to-face) nature of the research design, distance was a primary consideration in selecting which companies to contact. A preliminary list of 948 companies within three surrounding area codes (i.e., within a three hour drive) was generated. Because the focus of the study is on opportunity evaluation decision policies, and because the president/CEO/owner in small-medium sized companies is likely to have a larger role in making decisions about which opportunities to pursue than a president/CEO/owner in a large company, the list was further narrowed to companies with 10-500 employees—a range that approximates U.S. and European definitions of small and medium-sized enterprises (Commission of the European Communities, 2003; Barreto, 2004). There were 677 companies that met this requirement in the database. Lastly, only companies that gave the

contact information for the president/CEO/owner were included, meaning that records which only contained contact information for a chairman of the board, a manager, a plant manager, a general manager or a vice president were excluded. Again, this is because such individuals were thought to be less likely to be the primary decision maker vis-à-vis entrepreneurial opportunities. All told, there were 459 companies that met the above criteria.

Because of the complexity of data collection (i.e., an in-person visit to each company location), but also because of the experimental nature of this research, a target sample size of approximately 120 was set in order to provide sufficient power to test the hypotheses, but also remain a manageable data collection undertaking consistent with other studies using experiments (e.g., McNatt & Judge, 2004) and conjoint analysis (e.g., Shepherd, 1999a). To arrive at the final sample and to ensure that this was representative of the larger sample, each company was randomly assigned to one of four waves of data collection. I then contacted the entrepreneurial decision makers based on the wave they were assigned until the target sample size was met. Thus, an insufficient response by the presidents/CEOs/owners of the 240 companies in the first wave would have resulted in recruitment materials being sent to the smaller second wave and so on.

To recruit entrepreneurial decision makers, two letters were generated. The first letter was from the director of the University-affiliated entrepreneurship center. This was done for two reasons. First, the entrepreneurship center director is well respected by the business community and it was thought that this would



increase participation rates. Second, a letter from the entrepreneurship center director provides a critical link to practitioners. Hence, in this letter, the director introduced the researchers, briefly described the purpose and benefits of the research for both theory and practice and requested participation on the part of the letter recipient. The second letter included with the recruitment materials was from the primary researchers (i.e., dissertation committee chair and the author). This letter described in more depth the purpose of the research, explained the reason that the recipient was contacted and informed the recipient that I would call them to request their participation within a few days. Copies of both letters are included in Appendix B1 and Appendix B2, respectively.

So as to produce a constant but manageable flow of interviews, recruitment materials were mailed in groups of approximately twenty-five (based on geographical proximity). Within a week of the mailing, a follow-up phone call was made to the letter recipients (i.e., the president/CEO/owner of the company) in order to set-up a time to meet. A copy of the follow-up phone script is included in Appendix B3. Data were collected over a five month period in late 2005 and early 2006. Of the companies contacted in the first wave, four were no longer in business. Because of university institutional review board policy, potential entrepreneurial decision makers could be contacted (i.e., sending correspondence by mail, corresponding with on the phone or leaving a phone message) a maximum of five times. Within the first wave of companies, 127 individuals agreed to participate. Each individual who participated was a key decision maker in their organization. All but four of these individuals were the

president, CEO or owner at the company with which they are associated; and the four who were not in one of these positions participated *at the request* of the president, CEO or owner, once the purpose of the study was made clear.

The remaining entrepreneurial decision makers in the first wave were not available during the five month data collection period ( $n = 11$ ), could not be reached ( $n = 74$ ), or declined to participate when asked ( $n = 24$ ). This results in a response rate of 54 percent, a very respectable rate of response for this kind of research. A logistic regression of entrepreneurial decision makers' response on firm age, firm size and firm type was used to test for response bias. None of the factors in the regression were significant, providing no significant evidence of response bias. The mean age of entrepreneurial decision makers' firms was 35 years (median age was 24 years) and the mean size of entrepreneurial decision makers' firms was 98 employees with \$23 million in sales (median size was 40 employees with \$5 million in sales). The majority of entrepreneurial decision makers in the sample were men (95 percent), the mean sample age was 52 years, and 58 percent of the entrepreneurial decision makers were firm founders.

**Research Task.** Entrepreneurial decision makers engaged in a decision-making task in which they were asked to evaluate a series of hypothetical opportunities and decide whether or not to invest in the full-scale exploitation of each opportunity. In discussing techniques for investigating decisions, Priem and Harrison (1994) suggested two kinds: decomposition techniques (which break decisions down into smaller parts) and composition techniques (which build up a decision based on verbal descriptions). Decomposition techniques (which

include conjoint analysis and policy capturing) focus on the content of the decisions that are made, while composition techniques (which include verbal protocol analysis and causal mapping) focus on the cognitive processes underlying these decisions. Because the focus of this study is the content of entrepreneurial decision makers' opportunity evaluation decisions, I take a decomposition approach and utilize conjoint analysis. Specifically, I use metric conjoint analysis because it: (1) allows the researcher to obtain real time (versus post hoc) assessment of a respondent's cognitive system, (2) accommodates the investigation of the underlying structure of an individual's cognitive system (in-use decision policy) while also allowing measurement of the observable features of a cognitive system (espoused decision policy) through self-report techniques, and (3) permits the detection of interactions between specific aspects of a decision policy.

In its implementation, metric conjoint analysis "requires respondents to make a series of judgments based on a set of attributes (cues) from which the underlying structure of their cognitive system can be investigated" (Shepherd & Zacharakis, 1997: 211). Consistent with this approach, four theoretically relevant attributes made up the hypothetical opportunities or profiles that entrepreneurial decision makers evaluated in this study: potential value of an opportunity, knowledge relatedness of an opportunity, window of opportunity availability, and number of potential opportunities. Each attribute was varied at two levels. Based on the specific combinations of these attributes, the entrepreneurial decision makers decided their likelihood of *investing* in a specific opportunity. To measure

the likelihood investment, I used a 9-point scale anchored by very likely to invest in this opportunity (9) and very unlikely to invest in this opportunity (1). When making these decisions entrepreneurial decision makers were asked to assume that: (1) other than the information provided in the profiles, the hypothetical opportunities presented are similar to other entrepreneurial opportunities they have “seen” in all respects;(2) they have the resources (or access to the resources) to invest in an opportunity, if they choose to do so; (3) they are making decisions about these opportunities for their current firm; and (4) they are making decisions about these opportunities in their current industry and economic environment.

While the specific operationalizations of the four decision-task attributes will be given in the description of the methods related to study two, it is important to reemphasize that each was varied at two levels. Because a conjoint experiment with a fully crossed factorial design involving four attributes at two levels requires 16 ( $2^4$ ) profiles, an orthogonal fractional factorial design—meaning no correlation between attributes—was used to make the decision-making task more manageable (Green & Srinivasan, 1990), which results in 8 profiles (Hahn & Shapiro, 1966). In this fractional factorial design, all of the main effects are testable as well as three two-way interaction effects. This means that for each entrepreneurial decision maker, only three of six possible interaction effects can be tested.<sup>16</sup> This is seen as sufficient, however, for measuring

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<sup>16</sup> The fractional factorial design allows for all of the hypothesized effects within study two to be tested.

decision-policy consciousness because decision policies with more than three contingent relationships are rare (Louviere, 1988).

Each of the 8 profiles was fully replicated, permitting estimates of individual subject error for use in subsequent analysis (Shepherd, Zacharakis, & Baron, 2003). To avoid order effects, both the original and the replicated sets of profiles were randomly assigned. Entrepreneurial decision makers were then familiarized with the task through use of a practice profile. In addition, three additional profiles were created for use in the experimental manipulations (to be discussed in the next section), resulting in a total of 20 profiles.

**Figure 6: Experimental Data Collection Procedures**

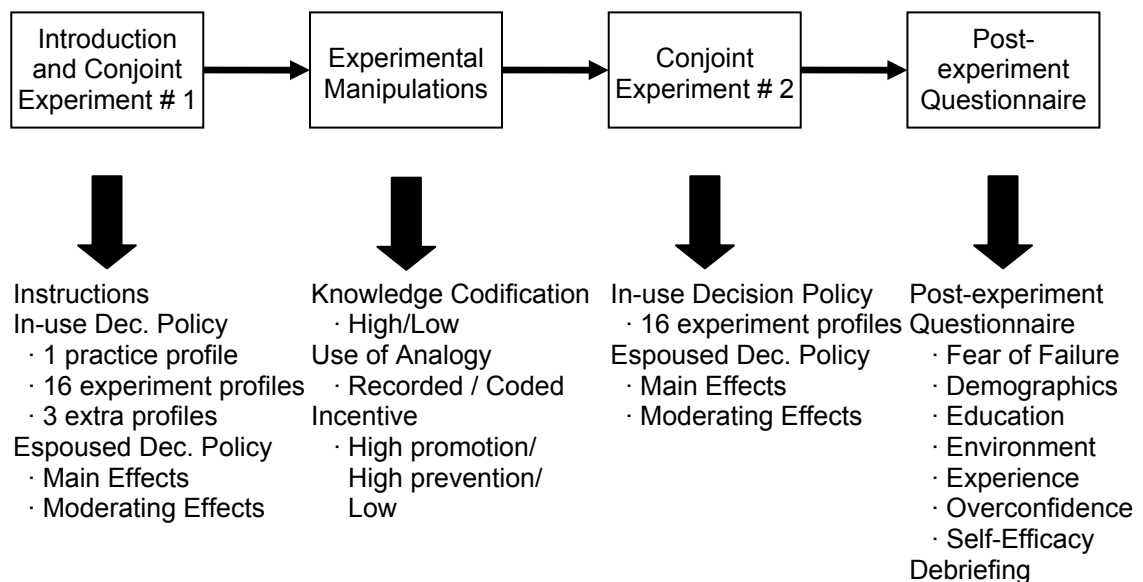


Figure 6 outlines the data collection process. It highlights the flow of the experimental session with entrepreneurial decision makers. As is noted in the figure, the experimental design used required entrepreneurial decision makers to engage in the opportunity evaluation decision-making task both before and after the experimental manipulations. Prior to the experimental manipulations,

entrepreneurial decision makers evaluated 16 profiles, plus 3 additional profiles which were used in the manipulations; while after the manipulation entrepreneurial decision makers only evaluated the 16 profiles. Immediately following both decision-making tasks, which measured the entrepreneurial decision makers' in-use decision policies, self-report measures were also collected that reflect their espoused decision policies.

***Manipulations and Measures.*** The experiment was conducted with entrepreneurial decision makers in person (at their place of work in all cases but one). Two experimental manipulations were used in this study: knowledge codification and decision communication incentive. In the case of knowledge codification, entrepreneurial decision makers were randomly assigned to either high or the low conditions. In the case of decision communication incentive, entrepreneurial decision makers were randomly assigned to the promotion/gain-focus, prevention/loss-focus, or no decision communication incentive conditions. Use of analogy was also measured; but because distinctions between types of similarity used in analogy are not dichotomies, this variable is not manipulated; rather, all entrepreneurial decision makers are asked the same questions, the responses to which were coded for inclusion in the analysis. A copy of the verbal protocol for the experiment is contained in Appendix C.

#### Knowledge Codification

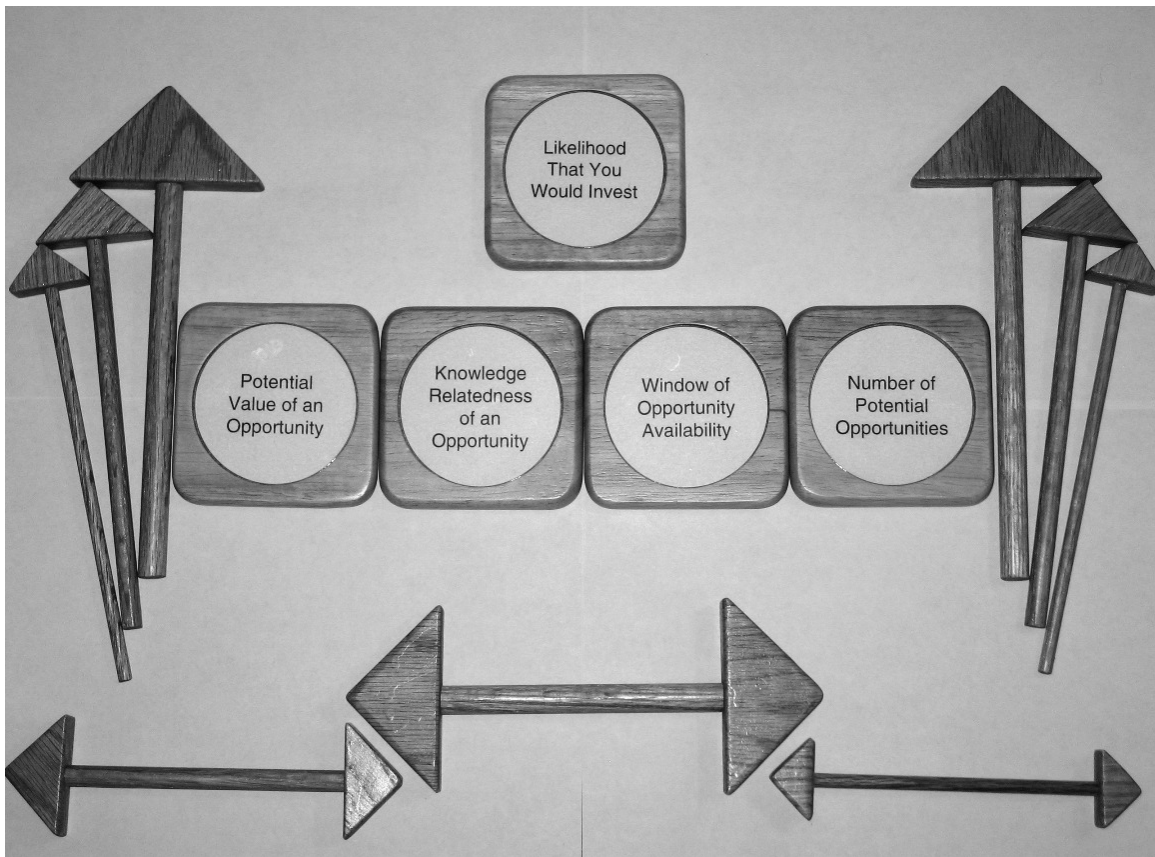
The first manipulation, knowledge codification, involved conversion of proceduralized expert knowledge into identifiable rules and relationships that can be easily communicated (Cowan & Foray, 1997; Kogut & Zander, 1992).

Knowledge codification consists of three elements: (1) model building, (2) language creation and (3) the writing of messages (Cowan & Foray, 1997). Because the language used in the decision context is provided in the conjoint activity, manipulation of knowledge codification only included model building and the writing of messages through visual depiction.

In the high knowledge codification condition, entrepreneurial decision makers were asked to visually describe their decisions using visual depictions of the attributes that were included in the opportunity profiles. Specifically, entrepreneurial decision makers were given: (1) five labeled wood blocks—four of which corresponded to the four opportunity evaluation decision attributes and the fifth denoting the decision to invest, and (2) three sets of both uni-directional and bi-directional wooden arrows—one small set, one medium set and one large set. Using these weighted arrows, entrepreneurial decision makers were asked to use these depictions of factors to visually describe how they make investment decisions, with the large arrows representing high importance, the small arrows representing low importance and the bi-directional arrows representing one factor depending on another. This resulted in a codified model of their opportunity evaluation decision policy—similar to a cognitive map (Huff & Jenkins, 2002). Once a visual model had been created, entrepreneurial decision makers were then presented, in turn, with each of the 3 additional conjoint profiles that they had evaluated during the first decision task combined with their evaluation (i.e., likelihood to invest) of each profile. Entrepreneurial decision makers were asked to use the visual model that they had created to talk through each of the profiles

that they had previously scored. Pictures of the materials used in the high knowledge codification manipulations are contained in Figure 7.

**Figure 7: High Codification Materials**

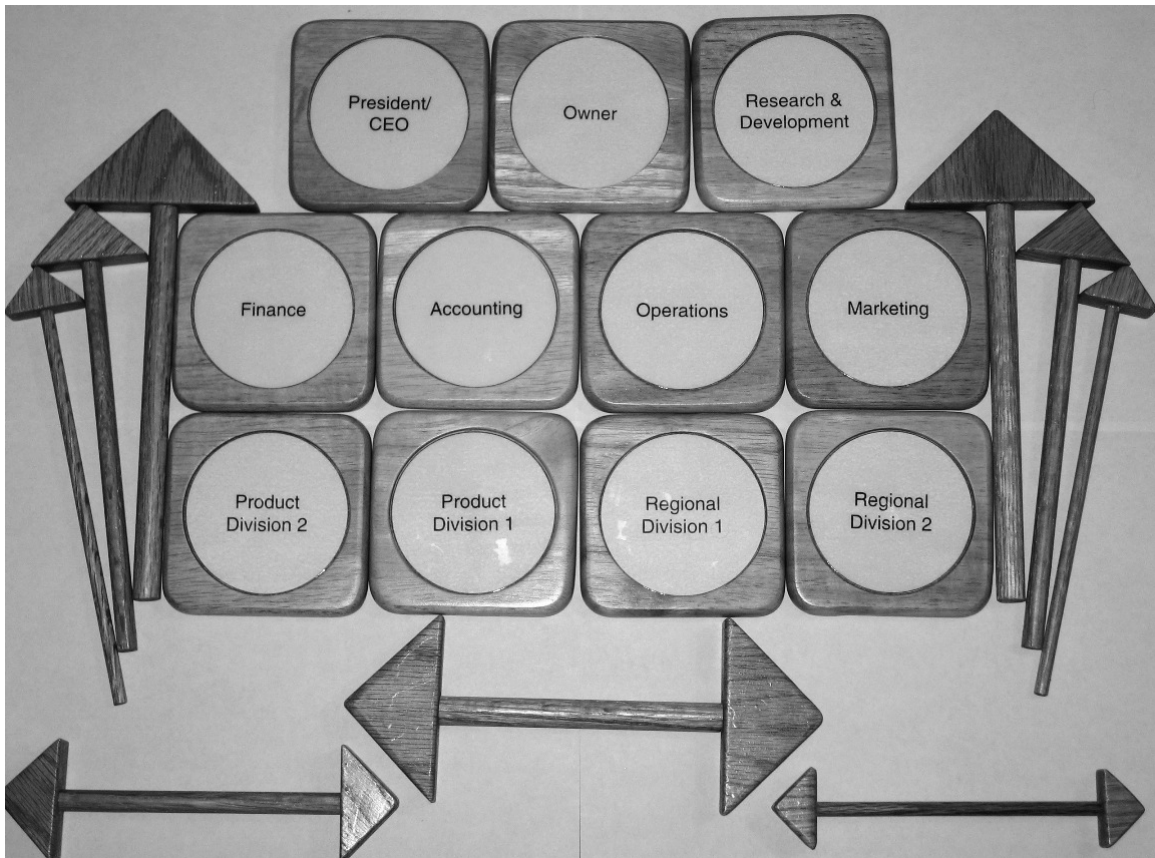


Entrepreneurial decision makers in the low knowledge codification condition were asked to talk about how their decisions relate to their firm. Specifically, entrepreneurial decision makers were given: (1) eleven labeled blocks—each denoting a separate aspect/level of firm structure (e.g., president/CEO, marketing, etc.), and (2) three sets of both uni-directional and bi-directional wooden arrows—one small set, one medium set and one large set. Using the wood blocks and arrows, entrepreneurial decision makers were asked to visually describe who in their firm has an important role in making decisions about whether or not to invest in an opportunity, with large arrows representing



high importance, the small arrows representing low importance and the bi-directional describing joint decisions. Entrepreneurial decision makers in this condition were not presented the three additional conjoint profiles that they had evaluated during the first decision task. Pictures of the materials used in the low knowledge codification manipulations are contained in Figure 8.

**Figure 8: Low Codification Materials**



#### Decision Communication Incentive

The second manipulation, decision communication incentive, involved a set of circumstances that can incite individuals to take some action (Neufeldt & Guralnik, 1997). Three forms of incentive motivation are suggested in the performance literature that are theoretically relevant to the current decision: (1)

monetary rewards, (2) social recognition and (3) performance feedback (Stajkovic & Luthans, 2001). As is previously suggested, monetary incentives related to residual risk are relevant in entrepreneurship. But because the individuals involved in this study were entrepreneurial decision makers who were voluntarily participating in this study, money would likely have little effect as a manipulation and, thus, was not used as a part of the incentive motivation manipulation. Rather, the decision communication incentive manipulation was achieved through social recognition (personal attention, mostly conveyed verbally, through expressions of interest, approval, and appreciation for a job well done (Stajkovic & Luthans, 2001:582)) and performance feedback about the process (information regarding a level of performance and/or the manner and efficiency in which performance processes have been executed (Stajkovic & Luthans, 2001:583)).

As is described previously, incentives can be framed in terms of either gains/non-gains (promotion focus) or losses/non-losses (prevention focus). Both framings were included in the experimental manipulation, as well as a control condition with no decision communication incentives. There were five parts to the promotion-focus incentive motivation manipulation. First, at the beginning of the study, entrepreneurial decision makers in this condition were told: “You should do very well.” Second, throughout the study, entrepreneurial decision makers in this condition were told that the process was going well (a total of five times<sup>17</sup>). Third, following the first portion of the study, entrepreneurial decision

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<sup>17</sup> The language varied: (1) well done, (2) perfect!, (3) this is exactly right, (4) this is going well, and (5) this is going smoothly.

makers were told: “You did a great job, well done. This is going marvelously and will be very helpful to my research. Thank you for your help.” Fourth, during the presentation of the knowledge codification and use of analogy manipulations, entrepreneurial decision makers were informed that: “What we are going to do now is quite important. It is the focus of the study, the part that I am most interested in and the part where you can help the most.” Fifth, prior to the reporting their espoused decision policy during the second half of the study, entrepreneurial decision makers were instructed that: “Based on the previous discussion of your decisions, it is important that you successfully report the factors that most closely represent your actual decisions. Again, this is the essential part of the study. Thank you for taking it so seriously.”

Similarly, there were five parts to the prevention-focus incentive motivation manipulation. First, at the beginning of the study, entrepreneurial decision makers in this condition were told: “You shouldn’t do poorly at all.” Second, throughout the study, entrepreneurial decision makers in this condition were told that the process was not going poorly (a total of five times<sup>18</sup>). Third, following the first portion of the study, entrepreneurial decision makers were told: “Not bad at all. I don’t think this will spoil my results. Thank you.” Fourth, during the presentation of the knowledge codification and use of analogy manipulations, entrepreneurial decision makers were informed that: “What we are going to do now is quite important. It is the focus of the study, the part that I am most interested in and where I need you to be most careful.” Fifth, prior to the reporting

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<sup>18</sup> The language varied: (1) not bad!, (2) not bad at all!, (3) that is definitely not wrong, (4) this isn’t going badly, and (5) this isn’t going poorly at all.

their espoused decision policy during the second half of the study, entrepreneurial decision makers were instructed that: “Based on the previous discussion of your decisions, it is important that you do not mistakenly report the factors that don’t most closely represent your actual decisions. Again, this is the critical part of the study. Thank you.”

Entrepreneurial decision makers in the low decision communication incentive condition did not receive: (1) instruction regarding the quality of the process or their performance, (2) a show of gratitude for their participation (until after data collection), (3) information on the importance of specific activities, or (4) information regarding the importance of accurately reporting the factors that most closely represent their actual decision policy. Entrepreneurial decision makers did, however, receive standard instructions for the various activities.

A pre-test of the manipulation was included during pilot testing and the manipulations were evaluated and modified based on the findings of these pilot tests. A manipulation check was also included in the post-experiment questionnaire.

### Analogy

Use of analogy involves the comparison of a new situation to a more familiar situation in order to better understand the new situation (Sternberg, 1977). As is discussed previously, structural similarity figures prominently in both matching and mapping processes (Gentner & Toupin, 1986) as well as in assessing the soundness of matching and mapping processes, whereas surface similarity is only helpful in analogy retrieval processes. Structural similarity is thus

thought to be more instrumental in increasing decision-policy consciousness than surface similarity and is thus the focus of this variable.

Measurement of use of analogy involved asking entrepreneurial decision makers to describe their opportunity evaluation decisions using analogy. Specifically, entrepreneurial decision makers were asked to describe a decision in another area of their life that might be like their decisions about opportunities—whether it's a family decision, a political decision or a decision about hobbies or interests—and then to describe how this decision was like their decisions about opportunities. These responses were recorded, transcribed and subsequently coded by trained raters—two Ph.D. students not otherwise involved in the execution of the study—for use of structural analogical similarity between decisions using a seven point continuous scale anchored by high structural similarity (7) and low structural similarity (1). In addition to structural similarity, other analogy-related information was coded by the raters (e.g., surface similarity) that is not used in testing the hypotheses related to study one.

As is noted previously, entrepreneurial decision makers were asked to make investment decisions based on a combination of four factors, each varied at two levels. In this decision context, structural similarity was based on the underlying similarities between entrepreneurial decision makers' decisions *that were like* their decisions to invest and the factors that were used in their in-use investment decisions. Thus, raters were provided with a numeric breakdown of the significant factors in the actual investment decisions (prior to the experimental manipulations). The numeric breakdowns were generated through

regression (main and interaction effects) of each entrepreneurial decision maker's investment decisions on the decision policy attribute; and included the percentage that each attribute contributed in the total decision as well as the direction of the effect.

Raters scored an entrepreneurial decision maker's response as having high structural similarity (7) if the response (the transcription of their target decision) was related to 80-100% of the actual decision factors/decision factor interactions. Raters scored an entrepreneurial decision maker's response as having high-medium structural similarity (4 to 6) if the entrepreneurial decision maker's response was related to 50-80% of the decision factors/decision factor interactions. Raters scored an entrepreneurial decision maker's response as having low-medium structural similarity (2 to 4) if the entrepreneurial decision maker's response was related to 20-50% of the decision factors/decision factor interactions. Lastly, raters scored an entrepreneurial decision maker's response as having low structural similarity (1) if the entrepreneurial decision maker's response was related to none of the decision factors/decision factor interactions. The analogy coding instructions are included in Appendix D.

Inter-rater agreement, agreement defined as a difference in ratings of two or less between raters, was 87 percent. To evaluate the reliability of the measures of structural similarity, intraclass correlations for structural similarity were evaluated. To calculate the intraclass correlation coefficients, I used a two-way mixed model (SPSS, 2004), defining agreement in terms of absolute agreement (instead of consistency). I took this approach for two reasons. First, a

two-way mixed ANOVA model controls for systematic variability among raters in cases when raters can be treated as fixed factors, restricting inferences about the reliability to the raters (Nichols, 1998), which in this case was limited to two Ph.D. students. Second, an absolute agreement measure was used in order to account for systematic differences between raters (Nichols, 1998). In a sense, the absolute agreement intraclass correlation coefficient takes into account the possibility that one rater's scores were higher than the scores of the other rater. In this sense, a two-way mixed ANOVA model, with an absolute agreement measure of agreement provides the strongest test of inter-rater reliability. Using this method, the intraclass correlation coefficient for the measure of structural similarity was 0.72 ( $p < .01$ ), with a Cronbach's alpha of 0.75. These scores fall within acceptable ranges for reliability measures (Nunnally, 1978).

In order to meaningfully sum the raters' scores, the sixteen cases with differences in ratings of greater than two were reconciled through independent rater agreement. The independent agreement method—as opposed to a forced rater agreement method—is important because the underlying statistical procedures of reliability assume independence. To facilitate the process, the two raters met to discuss their scoring rationale for each of the sixteen cases. Following discussion of each case, the individual raters then chose whether or not to change their original score. In half of the cases, either one of the two raters kept the original score, suggesting that reconciliation was not simply just regression to the mean. In all sixteen cases, raters' reconciled scores were within the limits of agreement. Following reconciliation, the interclass correlation

coefficient for structural similarity was 0.86 ( $p < .05$ ), with a Cronbach's alpha of 0.86. Raters' scores were then summed to provide a measure of use of analogy.

#### Founder Status

Founder status was measured in the post-experiment questionnaire (which is described in more depth in a later section). Entrepreneurial decision makers were asked: "Are you the (or one of) the principal founder(s) of your current firm." Responses were contrast coded with *yes* coded as .5 and *no* coded as -.5.

#### Decision-Policy Consciousness

The dependent variable, decision-policy consciousness was measured by taking the difference between entrepreneurial decision makers' espoused and in-use decision policies at both time one and time two. To accomplish this, both the espoused decision policy and the in-use decision policy had to be expressed quantitatively. Discussed in more detail in subsequent paragraphs, the quantitative expression of the espoused decision policy was based on entrepreneurial decision makers' self-report descriptions of their decision making, while the quantitative expression of the in-use decision policy was based on regression weights stemming from entrepreneurial decision makers' decisions in the conjoint analysis. I discuss each in turn.

Entrepreneurial decision makers' espoused decision policies were uncovered through use of self-report (espoused) measures. While the measurement of espoused main effects on the decision to invest—potential value, knowledge relatedness, number of potential opportunities and window of



opportunity—was fairly straightforward (e.g., what factors do you consider in making a specific decision), the measurement of interaction effects was not as simple. In their investigation of methods for obtaining subjective descriptions of decisions, Cook and Stewart (1975) presented seven different methods for obtaining subjective ratings of decisions. While their findings suggest that the seven subjective methods do not significantly differ in their effectiveness, the second method they discussed, rating attributes on a 100-point scale, seemed most appropriate for this study because it balanced the need for a quantitative measure of espoused decision policy and the need to minimize the complexity of espoused decision-policy measurement.

In taking this approach, entrepreneurial decision makers were first asked: “When assessing the previous profiles, what things did you consider when making your investment decisions?” This open-ended question allowed entrepreneurial decision makers to more accurately espouse their true decision policies, free from suggestive cuing. Once entrepreneurial decision makers had reported the effects that they considered to play a significant role in their decisions, the sign/direction of these effects was determined by asking entrepreneurial decision makers whether they were more likely to invest when an attribute was at a *high* level (e.g., high knowledge) or the *low* level (e.g., low knowledge). An interaction effect between two attributes was recorded when entrepreneurial decision makers suggested that the importance of one attribute depended on another and was clarified by asking if the entrepreneurial decision makers were describing the effect of attribute A on attribute B. When such an

effect was present, entrepreneurial decision makers were asked if having a *high* level of attribute A was more important or less important when attribute B was at a *high* level, which helped determine the sign/direction of the interaction effect.

Entrepreneurial decision makers were then asked to assign a score between 0 and 100 for each of the attributes they used in their decisions based on its importance to their decisions (including any combination/interaction effects that they had reported). These scores represent the weighted espoused importance of each attribute which, combined with the sign/direction of the effect, allowed for comparison with the in-use effects. The materials associated with the measurement of the espoused decision policy are included in Appendix E.

The in-use decision policy was determined by first establishing which attributes were significant<sup>19</sup> for each entrepreneurial decision maker's in-use decision policy. Because conjoint analysis requires each individual to make a series of decisions, a properly designed study allows a researcher to create separate regression equations for each participant. The individual beta weights of these regression equations represent the importance of each attribute or combination of attributes in the decision.

In-use effects for each entrepreneurial decision maker were first calculated for the decision task at time one. Because the decision task used a fractional factorial design, only orthogonal combinations of three (of the possible six) interaction effects were estimable in a regression equation for each entrepreneurial decision maker. As such, two orthogonal regression models were estimated per entrepreneurial decision maker—each containing four main effects

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<sup>19</sup> p-value < 0.05

and three interaction<sup>20</sup> effects—to determine which attributes were significant for each entrepreneurial decision maker. Based on these models, a final regression equation was then created *for each entrepreneurial decision maker* with only the significant effects. Because only three of the six possible interaction effects could be included, this was done by giving first priority to the significant in-use interaction effects that matched an entrepreneurial decision maker’s espoused model at time one. After verifying the equation against the entrepreneurial decision maker’s espoused model at time two (to ensure that the model was calculable at time two as well), secondary priority was given to significant in-use effects that matched the entrepreneurial decision maker’s espoused model at time two. Lastly, significant effects were then included in the equation based on theoretical relevance, including significant in-use interaction effects that matched the hypothesized interaction effects (hypotheses 7b, 8b, and 9b). The same process was used to calculate the in-use effects at time two, except in creating the second equation the time-two espoused model was used as the governing model in determining which significant interaction effects should be included.

Once an in-use decision policy was determined for each entrepreneurial decision maker for both times one and two, the significant standardized regression coefficients for each entrepreneurial decision maker were summed resulting in a measure of the total significant effects that explain the in-use decision policy. Each significant individual standardized coefficient was then

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<sup>20</sup> The first model included the main effects and interaction between: potential value/knowledge relatedness, potential value/window of opportunity, and potential value/number of potential opportunities. The second model included interaction effects between knowledge relatedness/window of opportunity, knowledge relatedness/number of potential opportunities, and window of opportunity/number of potential opportunities.

divided by the measure of total in-use variance to result in a percent of the total effects explained by each in-use weight. A similar process was undertaken for the espoused weights. The espoused scores were summed, resulting in a measure of the total variance accounted for by the espoused decision policy. Each individual espoused score was then divided by the measure of total espoused variance to result in a percent of explained variance by each effect that makes up an espoused decision policy. Each in-use percentage weight was then matched with and subtracted from the corresponding percentage weight of the espoused decision policy. The absolute value of each difference represented the gap between the espoused and in-use decision policy for each respective attribute. These gaps were summed to result in a total gap between an entrepreneurial decision maker's espoused and in-use decision policy. Because a smaller gap suggests a greater decision-policy consciousness, the scores were then multiplied by minus one to result in a decision-policy consciousness measure in which a larger score indicates greater decision-policy consciousness.

**Data Analysis.** Ordinary least squares regression was used to test the hypotheses related to study one. This technique was selected over repeated measures analysis of variance (ANOVA)—the seemingly logical choice in a pretest-posttest control group design (Campbell & Stanley, 1963)—because ANOVA is not particularly well suited for use of continuous variables (which in this case is the use of analogy variable). An additional consideration that was used in selecting regression over ANOVA is that a repeated measures ANOVA can also lead to an erroneous understanding of the efficacy of treatment effects

(Huck & McLean, 1975). Huck and McLean suggested two alternate approaches to a repeated measures analysis of variance: (1) utilization of the pre-test scores to compute gain scores and (2) utilization of pre-test scores as a covariate within an analysis of covariance (ANCOVA) (1975: 516). In comparing the two alternatives Huck and McLean noted that the covariate method actually “results in a more sensitive test of possible differences among treatments” (1975: 516). As such, the regression equivalent of ANCOVA—which is a special case of regression (Cohen, Cohen, West, & Aiken, 2003)—was used in this study. Specifically, entrepreneurial decision makers’ decision-policy consciousness scores at time one controlled through inclusion in the data analysis as a covariates in the regression equation.

Additionally, inasmuch as entrepreneurial decision makers’ espoused decision policies are prone to fluctuation for reasons other than the manipulations—resulting in unexplained variance—I included an espoused change score to control for these fluctuations. The espoused change score was the sum of the absolute values of the differences between the espoused scores at time one and those at time two. Because an analysis of this variable suggested that it was not normally distributed, but rather had a heavy or long tailed distribution (Cohen et al., 2003), a square root transformation was used (Hair, Anderson, Tatham, & Black, 1998). The resulting variable was then standardized for use as a control variable in the final regression equation. To investigate the possibility of systematic differences in this score across conditions, I regressed the resulting espoused change score on knowledge

codification and decision communication incentive. As Table 1 denotes, the results indicate that changes in espoused decision policy: (1) were not significantly different between entrepreneurial decision makers in the high knowledge codification and the low knowledge codification conditions, (2) were not significantly different between entrepreneurial decision makers in the high decision communication incentive and low decision communication incentive conditions and (3) were not significantly different between entrepreneurial decision makers in the gains-focus and loss-focus incentive conditions.

Table 1: Results of Regression Analysis for Espoused Change<sup>a</sup>

Variables	Mean	s.d	<i>B</i>
Codification Contrast	0.00	0.50	0.09
Incentive Contrast 1: Low vs. High	0.00	0.47	0.08
Incentive Contrast 2: Loss vs. Gain	0.00	0.41	-0.06
<i>R</i> <sup>2</sup>			0.02
<i>F</i>			0.72
<i>n</i>			127

<sup>a</sup> Standardized coefficients are reported

## **Study Two – Opportunity Evaluation Decision Policy**

Because of the overlap in the studies, there are many similarities between the methods described in study one and the methods described in study two. In this section, I focus on the methods that are unique to study two.

**Research Participants and Task.** The same one hundred and twenty-seven individuals participated in study two as participated in study one. Because the details about the sample are contained in the previous section, they will not be repeated here. As is described in study one, conjoint analysis was used to investigate the content of entrepreneurial decision makers' opportunity evaluation

decision policies. A description of the conjoint task is also included in the previous section and is thus not repeated here. It is, however, important to note that while the testing of the hypotheses related to study one utilized the entrepreneurial decision makers' results of the decision making at both time one and time two, the testing of the hypotheses related to study two is done using the decision-making task at time one only.

***Manipulations and measures.*** The development of the measurement instrument occurred in two stages. In the first stage, experimental materials were developed based on extant theory (see Appendices F1-F3 for study two experimental materials) and then evaluated and modified based on focused interviews with entrepreneurial decision makers and pre-testing of the materials. In stage two, a post-experiment questionnaire was developed that includes measures related to the investigation of propositions 1-3. This questionnaire is also included in Appendix G.

**Stage One.** Within stage one, materials were developed, pre-tested and modified for final use in the experiment. Although the pre-testing process is described in the following paragraphs, only the experimental materials that were used in the study are presented here. As is noted previously, within this decision-making task a set of hypothetical opportunity profiles were presented to entrepreneurial decision makers who then decided their likelihood of investing in each specific hypothetical opportunity. Again, each opportunity profile consisted of a combination of four independent variables, each varied at two levels:

potential value of an opportunity, knowledge relatedness, window of opportunity availability, and number of potential opportunities. I will discuss each in turn.

### Potential Value

In the conjoint experiment, potential value took two forms: higher and lower. Entrepreneurial decision makers were instructed that higher potential value meant that: “The predicted profit from investment in the full-scale exploitation of this potential opportunity is *higher* than other opportunities you have successfully pursued after the predicted expenses (i.e., time, money and effort) have been taken into account.” Conversely, entrepreneurial decision makers were instructed that lower potential value meant that: “The predicted profit from investment in the full-scale exploitation of this potential opportunity is *lower* than other opportunities you have successfully pursued after the predicted expenses (i.e., time, money and effort) have been taken into account.”

### Knowledge Relatedness

Similarly, in the decision-making task knowledge relatedness took two forms: high and low. Entrepreneurial decision makers were instructed that high knowledge relatedness meant that: “The knowledge that is necessary to exploit this potential opportunity is *very similar* to the knowledge that you already possess.” Conversely, entrepreneurial decision makers were instructed that low knowledge relatedness meant that: “The knowledge that is necessary to exploit this potential opportunity is very different from the knowledge that you already possess.”



### Window of Opportunity Availability

Window of opportunity availability took two forms in the conjoint experiment: wide and narrow. Entrepreneurial decision makers were instructed that wide windows of opportunity meant that: “The next six months are free from changing conditions in the environment that will considerably shorten the length of time available to profitably invest in this potential opportunity.” Entrepreneurial decision makers were instructed that narrow windows of opportunity meant that: “The next six months will bring about changes in the environment that will considerably shorten the length of time available to profitably invest in this potential opportunity.”

### Number of Potential Opportunities

Lastly, in the decision-making task number of potential opportunities took two forms: many and few. Entrepreneurial decision makers were instructed that many potential opportunities meant that: “There are *several* potential opportunities with unknown potential value, knowledge relatedness and opportunity windows that you could choose to invest in and exploit.” Entrepreneurial decision makers were instructed that few potential opportunities meant that: “There is *one* potential opportunity that you could choose to invest in and exploit, the potential value, knowledge relatedness and opportunity windows of which are given in the opportunity profile.”

Once the experimental materials were developed, they were evaluated and modified based on focused interviews with entrepreneurial decision makers and pre-testing of the materials. As is noted in the description of the methods for

study one, Appendix A contains a copy of the interview guide that was used in developing the materials. Based on the interviews with four entrepreneurs, some minor modifications were made to the materials to better facilitate the understanding of the entrepreneurial decision makers. Similarly, following the modification of the materials, the experimental materials and procedures were pilot tested using nine graduate students and one owner of a technology firm (similar to the firms in the sample). This was done to ensure that the instructions, materials and procedures would be clear to entrepreneurial decision makers and that the conjoint materials did not contain nonsense profiles. As was the case following the interviews, some minor modifications were required following the pilot tests that improved the data collection process and refined the experimental instructions, materials and procedures.

**Stage Two.** The post-experiment questionnaire was designed to measure factors thought to be related to the opportunity evaluation decision. Specifically, in addition to the aforementioned decision communication incentive manipulation check, the questionnaire included measures of: environmental dynamism, firm demographics, entrepreneurial and general self-efficacy, attitudes about failure, use of intuition, industry experience, education, age, gender and overconfidence. I discuss each variable in turn.

The manipulation check assessed the efficacy of the decision communication incentive manipulation. In this manipulation check, entrepreneurial decision makers were asked whether they were more concerned about/interested in avoiding loss or seeking gain. Four questions were included,

each measured on a 7-point scale anchored by loss-avoidance phrases, e.g., avoiding mistakes (1) and gain-seeking phrases, e.g., getting it right (7). The reliability of this scale is ( $\alpha = 0.045$ ). Such a low reliability score suggests a problem with this scale, which I address in a later section.

Environmental dynamism was measured using a 7-item scale that is a variant of the Miller and Friesen (1982) dynamism scale and is similar to that used by Covin, Green and Slevin (2006). Entrepreneurial decision makers indicated on 7-point Likert-type scale the extent to which they strongly disagree (1) to strongly agree (7) with a series of statements regarding the competitive nature of the environment (Miller & Friesen, 1982). The reliability of the environmental dynamism scale, although low, was within acceptable ranges ( $\alpha = 0.73$ ).

Information about the age, size and type of each entrepreneurial decision maker's firm was also gathered. The firm age was calculated by subtracting the current year from the year of firm founding provided by entrepreneurial decision makers. Firm size was measured by asking entrepreneurial decision makers to provide: (1) the approximate number of full-time employees, or full-time equivalent employees, including owners who work for the company, and (2) the expected total sales for this year. These variables were not used in the analyses related to either study one or study two, but were included to provide an accurate portrait of the sample.

General self-efficacy was measured using a scale provided by Chen and Klimoski (2003). This 7-point Likert-type scale was anchored by strongly agree

(1) and strongly disagree (7). The reliability for this scale was within acceptable ranges ( $\alpha = 0.80$ ). Entrepreneurial self-efficacy was measured using a scale developed for use in this study. The items in this scale were based on the stages of entrepreneurship provided by Vesper (1996). Similar to the general self-efficacy scale, the eight items in the entrepreneurial self-efficacy scale were measured on a Likert-type scale anchored by strongly agree (1) and strongly disagree (7). The reliability of this scale was acceptable ( $\alpha = 0.83$ ).

Attitudes regarding failure were measured using an instrument provided by Conroy (2001) developed to measure fear of failure. While not originally designed for use in entrepreneurship, this instrument measures five dimensions related to fear of failure that, based on the interviews prior to data collection, seemed relevant. These dimensions are: fear of experiencing shame and embarrassment, fear of devaluing one's self-estimate, fear of having an uncertain future, and fear of important others losing interest, fear of upsetting important others. The sum of the five dimensions results in an overall fear of failure. The twenty-five questions intended to measure fear of failure use a 7-point Likert-type scale anchored by Do not Believe at all (1) and Believe 100% of the time (7).

The reliability for the overall fear of failure scale was high ( $\alpha = .91$ ).

Use of intuition variable was measured using three items included in the post-experiment questionnaire. The first of the items asked: How important are intuitive feelings in decisions about opportunities; rated on a scale anchored by not at all important (1) and very important (7). For the second item, entrepreneurial decision makers responded to the statement: My 'gut' tells me

when a given strategy I use will be most effective; rated on a scale anchored by not very much like me (1) and (7) very much like me. Using a similar scale, the third items required entrepreneurial decision makers to respond to the statement: I depend on my intuition to help me formulate strategies. The reliability for this scale was ( $\alpha = 0.86$ ).

Industry work experience was captured by asking entrepreneurial decision makers to report their total years of work experience in the same industry as the primary industry of their current firm. This variable represents specific human capital. Similarly, founder status was measured by asking entrepreneurial decision makers if they are a principal founder of their current firm. Responses were contrast coded with *yes* coded as .5 and *no* coded as -.5.

Education was measured by asking entrepreneurial decision makers to select the category of the highest level of formal education completed. The categories are: did not complete high school, high school, some university/college, associate degree, bachelor's degree, some graduate study, master's degree, and doctoral degree. General human capital was measured as a difference between those who did receive a four year university degree and those that did not. Responses were contrast coded with *university degree* as .33 and *no university degree* as -.67.

Overconfidence was measured in a consistent manner with previous research on overconfidence (e.g., Busenitz & Barney, 1997; e.g., Forbes, 2005). In essence, entrepreneurial decision makers were asked to respond to a series of five business trivia questions. Each question has five choices, one of which

was a correct answer. Entrepreneurial decision makers were then asked to indicate, on a scale of 20% to 100% their confidence in their answer (20% confidence being pure chance, 100% confidence being absolute certainty). Because entrepreneurial decision makers were informed that 20% indicated pure chance, any confidence rating that an entrepreneurial decision maker provided below 20% was automatically increased to 20% to avoid biasing later calculations. An overall measure of overconfidence was calculated in four steps. First, entrepreneurial decision makers' answers to the questions were then checked for correctness. Second, for each question that an entrepreneurial decision maker answered correctly, they were given a score of 100 and for each answer they answer incorrectly, they were given a score of zero. This score represents accuracy for each question. Third, entrepreneurial decision makers' confidence ratings (percentages) were subtracted from their accuracy to result in a measure of over- (and potentially under-) confidence for each question. Fourth, these scores were then summed and divided by five to result in an overall measure of overconfidence. As Forbes notes, this measure is not meant to test an individual's knowledge, but rather to test an individual's awareness of the limits of their knowledge (2005: 632).

**Data Analysis.** In study two, data were collected at two distinct levels of analysis: at the decision level and at the individual level. In the context of decision making, the term level of analysis refers to "the unit to which the data are assigned for hypothesis testing and statistical analysis" (Rousseau, 1985: 4). In order to accurately draw conclusions about the results, it is important that the

level of analysis be properly and accurately specified, both in the framing and testing of hypotheses and in the actual analyses of the data. To ensure that this is done, researchers can avoid aggregation of data across levels, correctly specify the level of a relationship between variables, and correctly specify the influence of outside factors on a relationship between variables (Rousseau, 1985: 5-9). So doing ensures that sufficient care is given to level differences such that the conclusions drawn are theoretically, methodologically and statistically sound.

Because opportunity evaluation decisions are nested within the individual making these decisions and because the decisions made by that individual are not independent of that individual, correct specification of level related to theory and method is easily dealt with. Correct theoretical specification of level was done through the development of hypotheses that focused on the individual making the decisions, not the decisions themselves. Correct specification of level related to methods was done inasmuch as the individuals in the study were asked to make a series of decisions; and then were separately asked to answer a series of questions about themselves as individuals.

Correct statistical specification of level is more complex in that traditional statistical techniques such as ANOVA and regression analysis are not able to take into account nested data. While data can often be aggregated (or disaggregated) to accommodate either of these techniques, the result is either weak statistical power and ignored variance (in the case of aggregation) or biased estimates of standard errors (in the case of disaggregation) (Hofmann,

1997; Seibert, Silver, & Randolph, 2004). Consequently, to accommodate the nested nature of the data, I used Hierarchical Linear Modeling (HLM) to test hypotheses 6-9 and propositions 1-3. In addition to accommodating nested data, HLM allows the researcher to explicitly model variance both within and between levels (Hofmann, 1997: 726), which controls for (and, in the case of propositions 1-3, tests for) differences between individuals, thereby facilitating a deeper understanding of the hypothesized effects. In HLM, the output—the intercept and slope of the equation—at one level serve as the dependent variable for a second level. At each level, a significant parameter estimate denotes an effect that is significantly different from zero. Thus, in study two a significant parameter estimate at level one denoted a decision-level effect (e.g., potential value) on the likelihood to invest; and a significant parameter estimate at level two indicated a significant individual-level effect (e.g., entrepreneurial self-efficacy) (Hofmann, 1997; Seibert et al., 2004).

The time-one decisions were used to test the hypotheses related to study two. This is because the time-one data reflected entrepreneurial decision makers' decisions prior to the major experimental manipulations related to decision-policy consciousness. Due to missing data for individual level items,<sup>21</sup> 121 cases were used in the HLM analysis. Because each of the 121 entrepreneurial decision makers made a series of 16 decisions at time one, the decision level of analysis consisted of 1936 observations.

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<sup>21</sup> There were 3 cases with incomplete measures for the fear of failure measure and 3 cases with missing data for the environmental dynamism measure.



## **CHAPTER V: RESULTS**

In this section I describe the results of the previous two studies. I do this in two sections. The first contains the results related to study one, while the second section contains the results related to study two.

### **Study One – Decision-Policy Consciousness**

**Data Screening.** Prior to testing the hypotheses, it was important to investigate the data to check for missing data, examine the cases for outliers and validate that the assumptions of regression are upheld. I consider each of these in the next sections.

**Missing data.** Of the 127 entrepreneurial decision makers in the study, two entrepreneurial decision makers had an in-use decision policy at either time one or time two that contained no significant effects. In addition, the responses of both of these entrepreneurial decision makers in the conjoint analysis were unreliable in either time one, time two or both. Although the responses of some of the other entrepreneurial decision makers were also not reliable, only the two cases that were not reliable *and* did not have significant in-use decision policies were dropped from the analysis for study one. Additionally, missing data in the independent variables in study one were not a problem. This is because of the experimental nature of study one, in which each entrepreneurial decision maker was randomly assigned to a treatment condition, received that treatment, and

gave a response to the coded analogy question. Additionally, all entrepreneurial decision makers answered the question relating to founder status.

Outliers. Hair et al. defined outliers as: “observations with a unique combination of characteristics identifiable as distinctly different from the other observations” (1998). Outliers represent a potential problem because they can have a “profound impact on the estimates of the regression coefficients and their standard errors, as well as on the estimate of the overall prediction,  $R^2$ ” (Cohen et al., 2003: 390). Outliers may represent errors in data entry, a rare observation, or a rare combination of factors related to a specific observation.

Several steps were taken to protect against outliers due to data entry error. First, significant parts of the data were entered electronically by entrepreneurial decision makers during the experiment. Specifically, entrepreneurial decision makers completed the conjoint task on a laptop computer. Second, those data that were not entered by entrepreneurial decision makers were instead input electronically with the help of an assistant. The role of the assistant was to verify the data that were entered during data collection (i.e., the espoused decision policy weights), and to dictate questionnaire data following completion of the study. The process of dictation facilitated greater accuracy because of an ability to verify the correctness of the data during the data input process.

Next, to evaluate whether or not any of the cases were outliers for reasons other than data entry error, I followed Cohen et al. (2003) who suggested that outliers are either due to leverage, discrepancy or influence. An investigation of

leverage involves an analysis of the extent to which a set of independent variables are unusual. One statistic that is useful in the investigation of leverage, and that is recommended by Cohen et al. (2003), is the centered leverage value. Essentially, this case level statistic measures the degree to which the observed values for a set of independent variables differ from the mean values for those independent variables. Those cases that are substantially higher than the remaining cases are thought to require additional analysis. A centered leverage value index plot was created (contained in Appendix H1) to facilitate the analysis of the centered leverage values. Based on this plot, it would seem that one case (see Table 2) may have undue leverage on the fit of the regression equation; thus, this case will be further evaluated.

Discrepancy was evaluated using the externally studentized residuals (*SDRES*). Essentially, an analysis of externally studentized residuals sheds light on the effects of removing a specific case from the regression. Cohen et al. (2003) noted that a visual inspection through use of an index plot can indicate which cases need particular attention. These authors also suggested that using a cutoff value can be informing, specifically noting that standard cutoff values for externally studentized residuals can range from  $\pm 2.0$  to  $\pm 4.0$ . Inspection of an index plot of the externally studentized residuals (contained in Appendix H2) did not seem to indicate large gaps between cases; however, using a cutoff value of  $\pm 2.0$ , eight cases (see Table 2) were identified that may represent discrepancy-based outliers. These cases will be further examined in conjunction with the other potential outliers.

Influence was evaluated using the *Cook's D* statistic, which provides information on the impact of a case on the overall model fit; and, as Hair et al. noted, is “considered to be the single most representative measure of influence on overall fit” (1998: 225). Similar to the *SDRES*, *Cook's D* is determined by looking at the properties of a regression equation with and without each case. It does so, however, by taking into account the influence of outlying studentized residuals as well as the leverage for that case. Again, a large gap—apparent upon visual inspection of an index plot—can indicate a problem (Cohen et al., 2003). Analysis of the index plot (contained in Appendix H3) indicated the possibility of one influence-based outlier.

**Table 2: Study One Regression Diagnostics**

<i>Case #</i>	<i>SDRES</i>	<i>LEV</i>	<i>Cook's D</i>
19	2.023	0.125	0.051
<u>27</u>	-2.867	0.098	0.076
32	-2.221	0.071	0.034
50	-2.258	0.090	0.044
51	2.145	0.061	0.028
56	-2.479	0.060	0.036
74	-2.451	0.061	0.036
75	0.234	0.226	0.001
84	2.077	0.072	0.030

Table 2 contains those cases that require further consideration as outliers based on the above analyses, along with the regression diagnostic statistics corresponding with these analyses. It is apparent from this table that case 27 is an outlier due to its high influence (*Cook's D*) and discrepancy (*SDRES*) statistics. This case was evaluated in more depth in attempt to understand the reasons that this case had such a high degree of influence. It was discovered that the in-use decision policy at time two for case 27 was not reliable. While

there were other cases with low reliability, none of the others had such a high degree of influence on the regression equation. Consequently, this case was removed from further analysis.

Assumptions of regression. There are a number of assumptions in regression that need to be checked prior to drawing conclusions about the data; specifically, I evaluate the following four suggested by Cohen et al. (2003): the assumption of normality, the assumption of no measurement error, the assumption constant variance in the residuals (homoscedasticity), and the assumption of independence of the residuals. In addition, I test for multicollinearity among the independent variables.

Normality was addressed through an analysis of a series of q-q plots, which provide “an excellent method of determining whether the data follow a normal distribution” (Cohen et al., 2003: 138). Because this is an experiment, only three variables are checked for normality: time-one decision policy, change in espoused decision policy, and structural similarity (note that the first and second of these are used as controls in the analysis). The q-q plots are contained in Appendices H4-H7. As has been noted previously, the error terms for the raw change in espoused decision policy score are of a non-normal distribution. Consequently, this variable was transformed using a square root transformation which was then standardized for use in the analysis. As can be seen in the lack of substantial variance from the superimposed line in the q-q plots, this transformed variable (along with the other variables) is near normal. Thus, no further remedial action was taken.

The assumption of no measurement error is mitigated by the experimental nature of this study. More specifically, of the variables included in the regression equation only one—structural similarity—required evaluation from a reliability standpoint; this is because the other variables were either experimental manipulations (i.e., knowledge codification and decision communication incentives) or were manifest variables wherein reliability was not an issue (i.e., decision-policy consciousness, founder status, and change in espoused decision policy). As has been noted previously, structural similarity had an acceptable level of inter-rater reliability (0.86).

The assumption constant variance in the residuals or homoscedasticity is “the assumption that dependent variable(s) exhibit equal levels of variance across the range of predictor variable(s)” (Hair et al., 1998: 73). To test this assumption, a series of residual plots were created. Specifically, I plotted the standardized residuals against the independent variables. Following the suggestion of Cohen et al. (2003), I included a random (fuzzy) number in the plots of the dichotomous variables to make any patterns between the residuals and the independent variables more visible. These graphs (contained in Appendix H8) suggested that heteroscedasticity may be a problem in the case of structural similarity. A series of transformations were performed on the structural analogy variable (e.g., inverse, log and square root) as an attempt to remedy the potential problem (Hair et al., 1998), but in each case the transformation exacerbated the problem. Thus, inasmuch as heteroscedasticity did not seem to be extreme, the original structural similarity variable was retained in the model.

There were no indications that any of the other variables violated the assumption of homoscedasticity.

The assumption of independence of residuals is not likely to be a problem in study one because the dependent variable is an entrepreneurial decision maker's decision-policy consciousness, which is independent of the decision-policy consciousness of other entrepreneurial decision makers. However, one possible test for independence of the residuals is the Durbin-Watson test. A value of 2 suggests complete independence. In this case, the Durbin-Watson statistic was 1.935 suggesting that there was not likely a problem with non-independence of the residuals.

Multicollinearity among the predictor variables is a potential problem in this study. There are a couple of reasons for this. First, time-one decision-policy consciousness was used as a control variable in the study, in addition to a score representing a change in the espoused decision policy. Albeit highly unlikely, both variables could theoretically be related. Second, calculations of the interaction effects were, obviously, based on the main effects that were hypothesized to interact. While steps have been taken to minimize the potential for multicollinearity—such as centering main effect variables prior to calculating interaction effect variables—it was nonetheless important to test for the presence of multicollinearity. This is done through an investigation of the variance inflation factor (VIF) associated with each independent variable. The largest of these was 1.195, which falls well below the generally accepted VIF limit of 10 (Cohen et al., 2003).

**Hypothesis Testing.** Table 3 shows the means, standard deviations and intercorrelations for all of the variables in study one. Before testing the hypotheses, it is necessary to report the results of the decision communication incentive manipulation check. As was previously noted, this manipulation check was included to verify the efficacy of the decision communication incentive manipulation. However, because the reliability of the scale used in the manipulation check was below acceptable ranges, a single item was used that most closely represented the theoretical rationale of the manipulation check. Specifically, I used an item that asked: In this activity I was more concerned with: avoiding mistakes (1) or getting it right (7). Because there were three decision communication incentive conditions, analysis of variance was used to check the efficacy of the manipulation. The results of the ANOVA were marginally significant ( $p < .09$ ). The mean manipulation check scores for the gain-focus, loss-focus and low conditions were, respectively 5.77, 5.54 and 5.20. This fits with the underlying theory of the manipulation. Namely, entrepreneurial decision makers in the gain-focus condition are expected to be closer to the “getting-it-right” end of the scale than those in the loss-focus condition. Conversely, entrepreneurial decision makers who receive no feedback are likely to be closer to the “avoiding-mistakes” end of the scale than the others due to the lack of *any* active feedback, leading to increased concern that negative (as opposed to positive) performance is the cause of the absence in decision communication incentives.



Table 3: Study One Means, Standard Deviations, and Correlations<sup>a</sup>

Variables	Mean	s.d	1	2	3	4	5	6	7
1. Time 2 Gap DV	-0.68	0.30							
2. Time 1 Gap (control)	-0.74	0.31	0.34 **						
3. Espoused Change Z-score (control)	0.00	1.01	-0.40 **	-0.25 **					
4. Founder Status <sup>b</sup>	0.07	0.50	-0.28 **	-0.10	0.03				
5. Codification: Control vs. Experimental <sup>c</sup>	0.01	0.50	0.12	0.09	0.09	0.06			
6. Incentive: Low vs. High <sup>d</sup>	-0.01	0.48	0.10	0.02	0.08	-0.14	0.01		
7. Incentive: Loss vs. Gain <sup>e</sup>	0.00	0.41	0.12	0.09	-0.07	-0.06	0.04	0.00	
8. Structural Similarity	4.45	1.55	-0.02	-0.07	0.17 *	0.07	0.14	0.06	-0.04

<sup>a</sup> n = 124

<sup>b</sup> Contrast coded: -.5 = non-founder; .5 = founder

<sup>c</sup> Contrast coded: -.5 = control; .5 = experiment

<sup>d</sup> Contrast coded: -.67 = low; .33 = high

<sup>e</sup> Contrast coded: -.5 = loss; .5 = gain; 0 = low

\*  $p \leq .05$

\*\*  $p < .01$

Prior to testing the hypotheses, it was important to understand the nature of decision-policy consciousness. As has been discussed previously, decision-policy consciousness is representative of intuitive thinking. To provide evidence of the link between intuition and decision-policy consciousness, but to also include the possible role of false intuition, decision-policy consciousness at time one was regressed on use of intuition, general self-efficacy, entrepreneurial self-efficacy, and overconfidence.

A similar process to that described previously was used in the investigation of outliers for this regression. Based on the centered leverage values, externally studentized residuals and the Cook's D values, four items were determined to be outliers. These are contained in Table 4. However, the analysis

**Table 4: Intuition Check Regression Diagnostics**

<i>Case #</i>	<i>SDRES</i>	<i>LEV</i>	<i>Cook's D</i>
9	-0.726	0.106	0.014
43	-2.077	0.041	0.043
54	0.432	0.109	0.005
<u>58</u>	-3.739	0.014	0.056
<u>63</u>	1.593	0.114	0.070
66	-2.055	0.038	0.039
75	2.117	0.006	0.012
<u>91</u>	-2.346	0.047	0.062
92	-2.133	0.014	0.020
<u>104</u>	1.758	0.104	0.077
116	-0.395	0.107	0.004

with and without outliers was different only in the significance of the intuition variable; namely the significance of this variable increased from marginally significant to significant upon deletion of the outliers. Because no theoretical reason seemed to exist for removing outliers, I report the regression results calculated with all of the cases. Table 5 displays these results. The marginally

significant negative effect of reported use of intuition on decision-policy consciousness, combined with non-significant effects for the other three variables provided support for the notion that decision-policy consciousness is representative of intuition: lower decision-policy consciousness corresponded with higher reported use of intuition.

**Table 5: Results of Intuition Check Regression Analysis<sup>a</sup>**

Variables	Mean	s.d	<b>B</b>
Use of Intuition	15.49	3.69	-0.17 <sup>†</sup>
General Self-Efficacy	47.31	4.57	0.06
Entrepreneurial Self-Efficacy	43.89	5.39	0.05
Overconfidence	0.33	21.16	-0.04
$R^2$			0.03
$F$			1.05
$n$			125 <sup>b</sup>

<sup>a</sup> Standardized coefficients are reported

<sup>b</sup> Two observations could not be included due to missing values

<sup>†</sup>  $p < .10$

Table 6 summarizes the OLS regression results for decision-policy consciousness. According to hypothesis 1, firm founders will have lower decision-policy consciousness than non-firm founders. As can be seen in model 2, founder status was negatively related to decision-policy consciousness ( $B = -.25$ ;  $p < .01$ ). This finding provides support for hypothesis 1.

Table 6: Results of Regression Analysis for Decision-Policy Consciousness<sup>a</sup>

Variables	Model 1	Model 2	Model 3	Model 4
Time 1 Gap (control)	0.26 **	0.24 **	0.21 **	0.23 **
Espoused Change Z-score (control)	-0.34 **	-0.34 **	-0.36 **	-0.36 **
Founder Status		-0.25 **	-0.24 **	-0.24 **
Codification Contrast			0.15 †	0.12
Incentive Contrast 1: Low vs. High			0.09	0.03
Incentive Contrast 2: Loss vs. Gain			0.05	0.02
Structural Similarity			0.00	0.02
Founder X Codification				0.16 *
Founder X Incentive 1: Low vs. High				0.05
Founder X Incentive 2: Loss vs. Gain				-0.06
Founder X Structural Similarity				-0.09
$\Delta R^2$		0.06	0.03	0.03
$R^2$	0.23	0.29	0.32	0.35
$F$	17.74 **	16.08 **	7.79 **	5.55 **
$n$	124	124	124	124

<sup>a</sup> Standardized coefficients are reported.

†  $p < .10$

\*  $p < .05$

\*\*  $p < .01$

Hypothesis 2 states that entrepreneurial decision makers who engage in knowledge codification will possess higher decision-policy consciousness than entrepreneurial decision makers who do not engage in knowledge codification. As is shown in model 3, the effect of knowledge codification on decision-policy consciousness was marginally significant and positive ( $B = .15$ ;  $p < .10$ ). This finding provides cautious support for hypothesis 2.<sup>22</sup>

<sup>22</sup> I hasten to note that in a model excluding all eight potential outliers, there is strong support for hypothesis 2; however, to err on the side of caution only the model that excludes one theoretically justifiable outlier is reported.

According to hypothesis 3a, entrepreneurial decision makers with high decision communication incentives will have higher decision-policy consciousness than entrepreneurial decision makers without high decision communication incentives. However, as can be seen in model 3, decision communication incentives were not significantly related to decision-policy consciousness ( $B = .09$ ;  $p > .05$ ). Thus, hypothesis 3 is not supported.

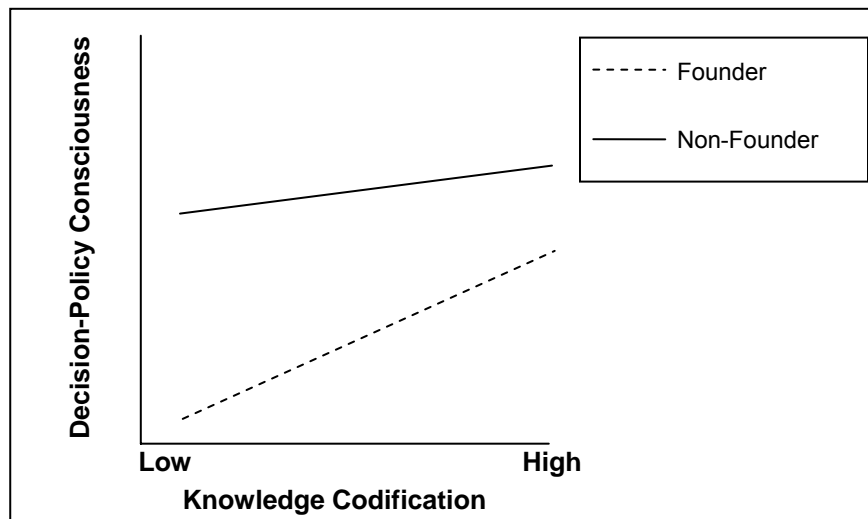
The argument of hypothesis 3b is that decision-policy consciousness about opportunity assessment will be higher for individuals whose decision communication incentives are framed in terms of a promotion focus (gains) than those whose decision communication incentives are framed in terms of a prevention focus (losses). As was the case with the previous hypothesis, the insignificant coefficient in model 3 ( $B = .05$ ;  $p > .05$ ) does not provide evidence that the type of decision communication incentives used impact decision-policy consciousness. Thus, hypothesis 3b is not supported.

Hypothesis 4 states that entrepreneurial decision makers who use structurally similar analogies to describe their decision policies will possess higher decision-policy consciousness than entrepreneurial decision makers who do not use structurally similar analogies. However, the non-significant coefficient in model 3 ( $B = .00$ ;  $p > .05$ ) does not provide evidence that use of structurally similar analogies impacts decision-policy consciousness. Thus, hypothesis 4 is not supported.

Hypotheses 5a-d address the interaction effects of founder status on the three mechanisms hypothesized to increase decision-policy consciousness.

According to hypotheses 5a, decision-policy consciousness about opportunity assessment increases as entrepreneurial decision makers engage in greater codification of their knowledge, but does so at a faster rate for founders than for non-founders. As expected, the positive and significant coefficient in model 4 ( $B = .16$ ;  $p < .05$ ) provides evidence for the interaction effect. Figure 9 displays the form of the interaction, confirming hypothesis 5a.

**Figure 9: Knowledge Codification x Founder Status**



Hypothesis 5b states that decision-policy consciousness about opportunity assessment increases as entrepreneurial decision makers' decision communication incentives increase, but does so at a faster rate for founders than for non-founders. And according to hypothesis 5c, decision-policy consciousness about opportunity assessment increases as entrepreneurial decision makers receive decision communication incentives framed in terms of a promotion focus (gains), but does so at a faster rate for founders than for non-founders. As can be seen in model 4, the interaction effects were not significant between founder

status and presence of decision communication incentives ( $B = .05$ ;  $p > .05$ ) and decision communication incentive type ( $B = -.06$ ;  $p > .05$ ). Thus, hypotheses 5b and 5c are not supported.

According to hypothesis 5d, decision-policy consciousness about opportunity assessment increases as entrepreneurial decision makers utilize structurally similar analogies to describe their decision policies, but does so at a faster rate for founders than for non-founders. As is evident in model 4, the interaction effect between founder status and analogy was not significant ( $B = -.09$ ;  $p > .05$ ). Thus, hypothesis 5d is not supported.

## Study Two – Opportunity Evaluation Decision Policy

Table 7 contains the descriptive statistics for the level-two (decision) variables. Because the design for study two is a fraction factorial orthogonal design the descriptive statistics for the level-one variables are not included. Note that the mean of the dependent variable at level one (likelihood of investment) is 4.47 and the standard deviation is 2.48 ( $n = 1936$ ).

Table 7: Study Two Means, Standard Deviations, and Correlations at Level Two<sup>a</sup>

Variables	Mean	s.d	1	2	3	4
1. Fear of Failure	78.32	22.00				
2. Entrepreneurial Self-efficacy	44.10	5.24	-0.07			
3. Education <sup>b</sup>	0.13	0.41	0.07	-0.15		
4. Industry Experience	21.89	10.06	-0.07	0.06	-0.13	
5. Environmental Dynamism	24.60	8.14	-0.06	-0.13	-0.10	0.15

<sup>a</sup>  $n = 121$

<sup>b</sup> Contrast coded:  $-.67$  = no university degree;  $.33$  = university degree

As is noted previously, HLM was used to test hypotheses 6-9. As already mentioned, a unique aspect of HLM is that it allows for the partitioning of

variance both within and between groups. In study two, a group consists of a series of decisions made by an individual. Thus, while the majority of the literature on HLM refers to within- and between-*group* variance, I instead refer to within- and between-*individual* variance for the sake of clarity in hypothesis testing.

In order to test the hypotheses related to study two, it is first necessary to verify that there is systematic variance both within *and* between individuals. This can be done through an investigation of a null model, or a model that includes neither level-one predictors nor level-two predictors. In this case, the null model partitions variance in likelihood of investment both within- and between-individuals. A  $\chi^2$  test on the null model ( $\chi^2 = 255$ ,  $df. = 120$ ,  $p < .001$ ) suggests that likelihood of investment varied significantly both within and between individuals. Moreover, calculation of an intraclass correlation coefficient (ICC) allows the researcher to understand the degree of between-individual variance. This is done using the within- and between-individual variance statistics.<sup>23</sup> The resulting ICC indicates that 6.6 percent of the variance in the likelihood of investment lies between individuals (Hofmann, 1997; Whitener, 2001).

A second question to be asked prior to testing the hypotheses using HLM is the extent to which the level-one factors (e.g., potential value) explain variance in the likelihood of investment across entrepreneurial opportunities, within individuals. This can be determined by calculating an  $R^2$  statistic using the between-individual variance for the null model and the between-individual

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<sup>23</sup> The formula is  $\tau_n / (\tau_n + \sigma_n^2)$  where  $\tau_n$  equals the between-individual variance of likelihood to invest (LTI) in the null model and  $\sigma_n^2$  equals the within-individual variance of LTI in the null model.



variance for the level-one models.<sup>24</sup> The resulting statistics indicate that: (1) the main effects model explains 62 percent of the variance in the between individual differences in likelihood of investing; and (2) a main/interaction effects model explains 64 percent of the variance.

A third question to be asked prior to testing the hypotheses (and investigating the propositions) using HLM is the extent to which level-two factors (e.g., fear of failure) explain between-individual variance. This is determined by first calculating the proportion of between-individual variance explained by the level-two factors.<sup>25</sup> The resulting statistic (.011) is then divided by the ICC (.066), to indicate that 16.7 percent of the total between-individual variance is explained by the level-two factors.

Hypotheses 6-9 were tested using the level-one HLM models referenced in the previous paragraphs. Specifically, significant t-values for each of the level-one parameters indicate the significance of that factor in the likelihood of investment, holding differences within individuals constant (Hofmann, 1997; Whitener, 2001). Table 8 contains the results of the HLM estimation used to test hypotheses 6-9.

Hypothesis 6 states that the higher the potential value of an opportunity, the more likely an entrepreneurial decision maker is to invest in that opportunity. As is expected and as is shown in model 2, the effect of value on likelihood of

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<sup>24</sup> The formula is  $(\sigma^2_n - \sigma^2_{one}) / \sigma^2_n$  where  $\sigma^2_n$  equals the within-individual variance of (LTI) in the null model and  $\sigma^2_{one}$  equals the within-individual variance of (LTI) in the level-one factors.

<sup>25</sup> The formula is  $(\tau_{one} - \tau_{two}) / \tau_{one}$  where  $\tau_{one}$  equals the between-individual variance of (LTI) in the level-one intercepts and  $\tau_{two}$  equals the between-individual variance of (LTI) in the level-two intercepts.

investing was significant and positive (*coefficient* = 2.577;  $p < .001$ ). This finding provides support for hypothesis 6.

Table 8: Results of HLM Estimation for Likelihood of Investment (Hypotheses 6-9)<sup>a</sup>

Variables	Model 1	Model 2	Model 3
Intercept	4.466 ** (0.079)	4.466 ** (0.079)	4.466 ** (0.079)
Potential Value		2.577 ** (0.102)	2.577 ** (0.102)
Knowledge Relatedness		2.542 ** (0.099)	2.542 ** (0.099)
Window of Opportunity Availability		0.441 ** (0.076)	0.441 ** (0.076)
Number of Potential Opportunities		0.274 * (0.100)	0.274 * (0.100)
Potential Value * Knowledge Relatedness			1.159 ** (0.141)
Potential Value * Window of Opportunity Availability			0.088 (0.122)
Potential Value * Number of Potential Opportunities			0.010 (0.107)
Deviance	8970.62	7224.38	7156.36
Deviance Difference		-1746.24	-68.02
Proportion of Variance Explained		62%	64%

n = 1936 at the decision level; n = 121 at the individual level

<sup>a</sup> Coefficient estimates are reported with robust standard errors in parentheses.

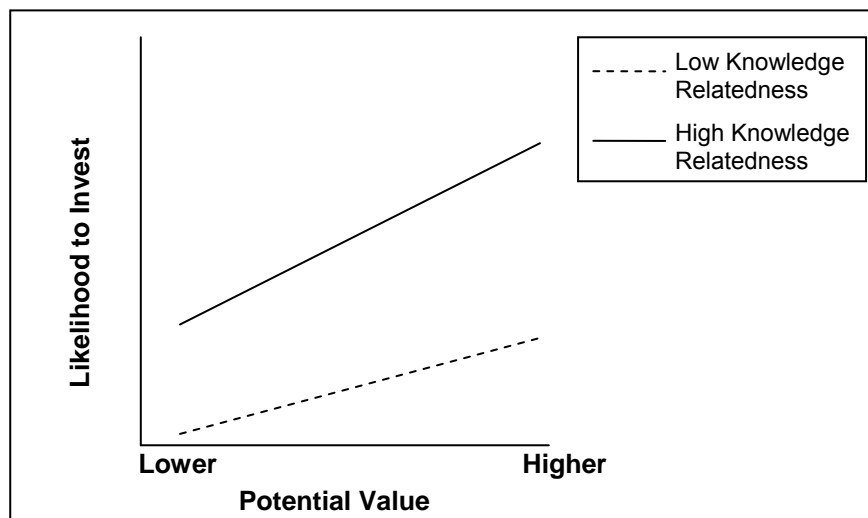
\*  $p < .01$

\*\*  $p < .001$

According to hypothesis 7a, the higher the knowledge relatedness of an opportunity, the more likely an entrepreneurial decision maker is to invest in that opportunity. As is seen in model 2, the effect of knowledge relatedness on likelihood of investment was significant and positive (*coefficient* = 2.542;  $p < .001$ ). This finding provides support for hypothesis 7a.

Hypothesis 7b states that the likelihood of investing in an opportunity increases with the potential value of an opportunity, but does so at a faster rate when knowledge relatedness of the opportunity is high. As the significant and positive coefficient in model 3 suggests (*coefficient* = 1.159;  $p < .001$ ), knowledge does affect the relationship between potential value and likelihood to invest; and as figure 10, suggests the form of the interaction is as expected in the hypothesis. These findings provide support for hypothesis 7b.

**Figure 10: Potential Value x Knowledge Relatedness**



According to hypothesis 8a, the narrower the window of opportunity availability, the more likely an entrepreneurial decision maker is to invest in that opportunity. As can be seen in model 2 the coefficient, while significant, is in the opposite direction of that which is hypothesized (*coefficient* = .441;  $p < .001$ ). Thus, hypothesis 8a is not supported.

The argument of hypothesis 8b is that the likelihood of investing in an opportunity increases with the potential value of an opportunity, but does so at a

faster rate when the window of opportunity availability is narrow. However, the non-significant effect contained in model 3 provides no significant evidence that window of opportunity availability impacts the relationship between potential value and likelihood of investment (*coefficient* = .088;  $p > .05$ ). Accordingly, hypothesis 8b is not supported.

According to hypothesis 9a, the fewer the number of potential opportunities available, the more likely an entrepreneurial decision maker is to invest in that opportunity. As can be seen in model 2 the coefficient, while significant, was in the opposite direction of that which is hypothesized (*coefficient* = .274;  $p < .001$ ). Thus, hypothesis 9a is not supported.

Hypothesis 9b states that the likelihood of investing in an opportunity increases with potential value of an opportunity, but does so at a faster rate when the number of potential opportunities available is few. However, the non-significant effect in model 3 provides no significant evidence that number of potential opportunities impacts the relationship between potential value and likelihood of investment (*coefficient* = .010;  $p > .05$ ). Accordingly, hypothesis 9b is not supported.

An exploration of propositions 1-3 should only happen if the results of the previous two analyses are indicative of cross-level effects: that is, there are significant differences both within and between individuals, and the level-one slopes and intercepts are significant. In light of the previous analyses, it would seem appropriate to test for effects of individual-level factors on the likelihood to invest. As is previously noted, cross-level effects are tested through use of an

equation that includes the level one intercepts and slopes as outcome variables. A significant coefficient of the level-two predictors (e.g., fear of failure) on the level-one intercept indicates that the level-two factor directly influences likelihood of investment—a kind of cross-level main effect. Similarly, a significant coefficient of the level-two predictors (e.g., fear of failure) on the level-one slopes (e.g., potential value) indicates that the level-two factor influences the relationship between level one factors—a kind of cross-level interaction effect.

Table 9 contains the results of the cross-level HLM estimation. Consistent with propositions 1, 2, and 3 (in part), attitudes about failure, entrepreneurial self-efficacy and general human capital, respectively, affect specific aspects of the opportunity evaluation decision, controlling for environmental dynamism.

Consistent with proposition 1, the significant coefficients for fear of failure relative to the slopes of potential value (*coefficient* = .011;  $p < .001$ ) and number of potential opportunities (*coefficient* = -.009;  $p < .05$ ) suggest that attitudes about failure do impact entrepreneurial decision makers' opportunity evaluation decisions. Figure 11 depicts the form of the effect that fear of failure has on the relationship between potential value and likelihood of investment. It suggests that compared to those with a low fear of failure, those with a high fear of failure are less likely to invest in opportunities with lower value; for opportunities with higher value, however, those with a high fear of failure are equally likely to invest as those with a low fear of failure.

Similarly, Figure 12 depicts the form of the effect that fear of failure has on the relationship between number of potential opportunities and likelihood of

Table 9: Results of HLM Estimation for Likelihood of Investment (Propositions 1-3)<sup>a</sup>

Variable Slopes / Level 2 Predictors	Level 2 Intercept	ENV. Dynamism	Fear of Failure	ENT Self-efficacy	Education (Gen. HC) <sup>b</sup>	Industry Exp. (Spec. HC)
Level 1 Intercept	4.466 *** (0.077)	-0.009 (0.009)	-0.003 (0.003)	0.002 (0.017)	-0.420 (0.228)	-0.006 (0.008)
Potential Value	2.577 *** (0.097)	0.005 (0.011)	0.011 ** (0.004)	0.045 (0.024)	0.565 * (0.286)	-0.005 (0.009)
Knowledge Relatedness	2.542 *** (0.099)	-0.009 (0.012)	-0.004 (0.005)	-0.005 (0.020)	0.126 (0.292)	0.001 (0.010)
Window of Opportunity Availability	0.441 *** (0.075)	-0.011 (0.010)	0.004 (0.003)	0.000 (0.014)	-0.077 (0.182)	-0.002 (0.008)
Number of Potential Opportunities	0.274 ** (0.097)	0.000 (0.011)	-0.009 * (0.004)	-0.021 (0.021)	-0.289 (0.298)	0.006 (0.010)
Potential Value * Knowledge Relatedness	1.159 *** (0.136)	0.006 (0.016)	0.002 (0.005)	0.020 (0.022)	0.826 * (0.373)	0.021 (0.014)
Potential Value * Window of Opportunity Availability	0.089 (0.122)	-0.004 (0.017)	-0.002 (0.005)	0.021 (0.025)	-0.266 (0.338)	0.000 (0.011)
Potential Value * Number of Potential Opportunities	0.010 (0.104)	-0.021 (0.012)	0.002 (0.005)	-0.048 * (0.021)	-0.090 (0.305)	0.008 (0.010)

n = 1936 at the decision level; n = 121 at the individual level

Deviance = 7329.85

<sup>a</sup> Coefficient estimates are reported with robust standard errors in parentheses.

<sup>b</sup> Contrast coded: -.67 = no university degree; .33 = university degree

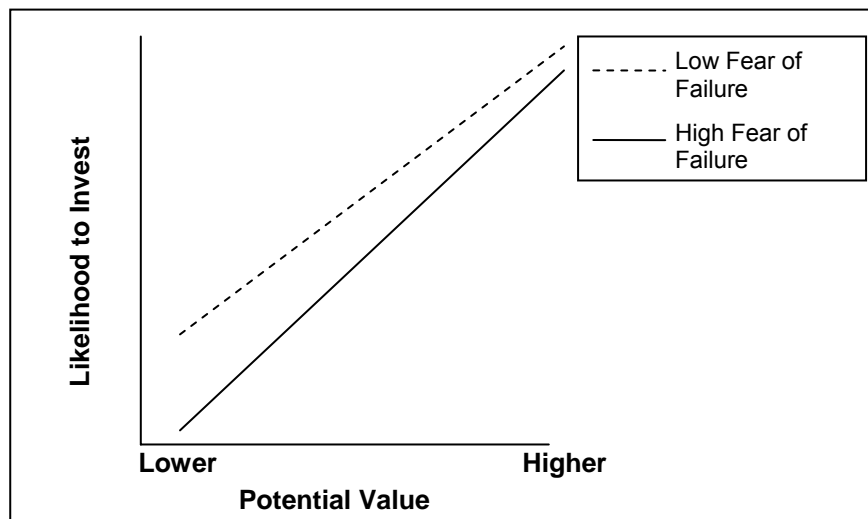
\*  $p < .05$

\*\*  $p < .01$

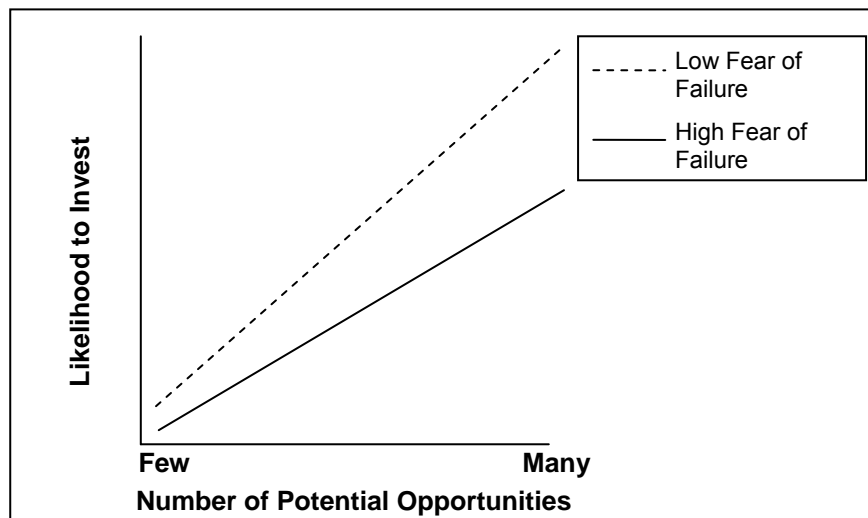
\*\*\*  $p < .001$

investment. It suggests that compared to those with a lower fear of failure, those with a high fear of failure are less likely to invest when the number of potential opportunities are many; but when the opportunities are few, those with a high fear of failure are equally likely to invest as those with a low fear of failure.

**Figure 11: Fear of Failure x Potential Value**

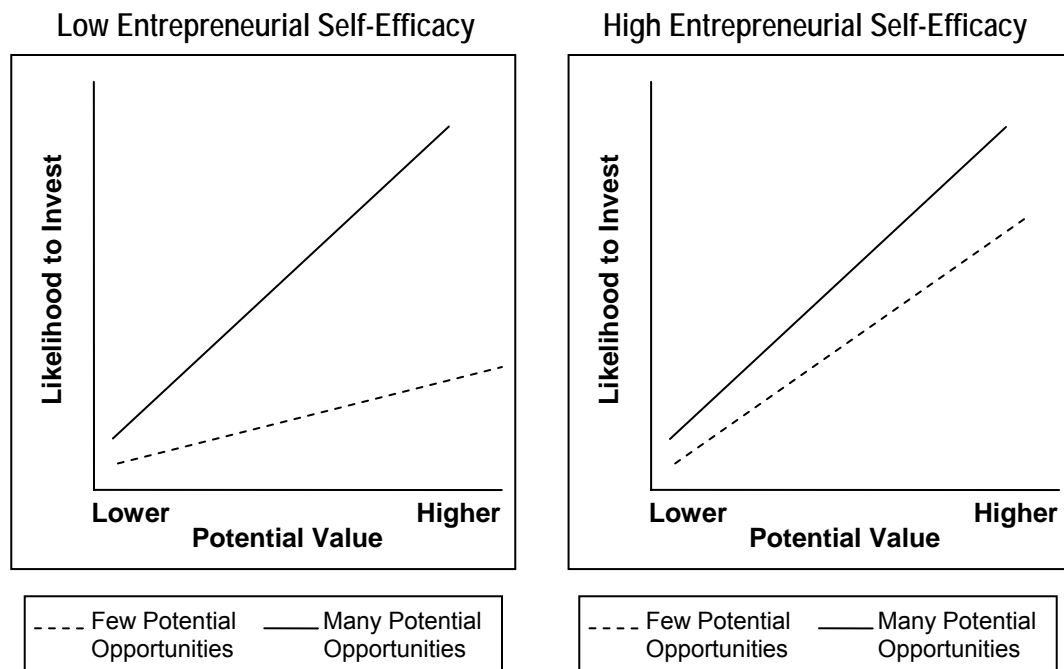


**Figure 12: Fear of Failure x Number of Opportunities**



Similarly, the significant coefficient for entrepreneurial self-efficacy relative to the slope of the interaction between value and number of potential opportunities (*coefficient* = -.048;  $p < .05$ ) provides evidence for proposition 2, which suggests that entrepreneurial self-efficacy influences entrepreneurial decision makers opportunity evaluation decisions. Figure 13, depicts the form of the effect that entrepreneurial self-efficacy has on the hypothesized interaction (albeit insignificant) between potential value and number of potential opportunities. It suggests that the positive relationship between potential value and likelihood to invest is enhanced more by a high number of opportunities when entrepreneurial self-efficacy is low than when it is high.

**Figure 13: Entrepreneurial Self-Efficacy x Number of Opportunities x Value**



Lastly, the significant coefficients for education relative to the slopes of potential value (*coefficient* = .564;  $p < .05$ ) and the interaction between potential



value and knowledge relatedness (*coefficient* = .826;  $p < .05$ ) lends partial support for proposition 3, which suggests that entrepreneurial decision makers' general human capital will have a significant effect on their opportunity evaluation decisions. Figure 14 depicts the form of the effect that general human capital (GHC) has on the relationship between potential value and likelihood of investment. It suggests that compared to those with high general human capital, those with low general human capital are more likely to invest in opportunities with lower value; but for opportunities with higher value, those with low general human capital are equally likely to invest as those with high human capital.

**Figure 14: General Human Capital x Potential Value**

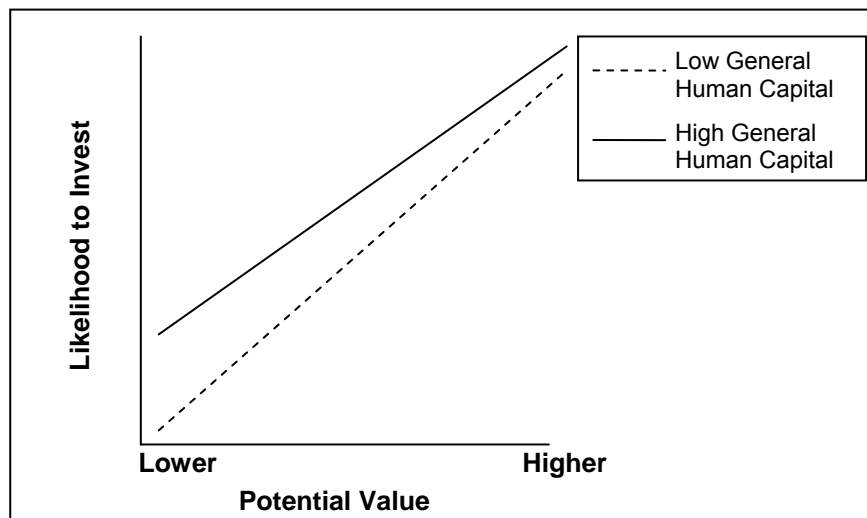
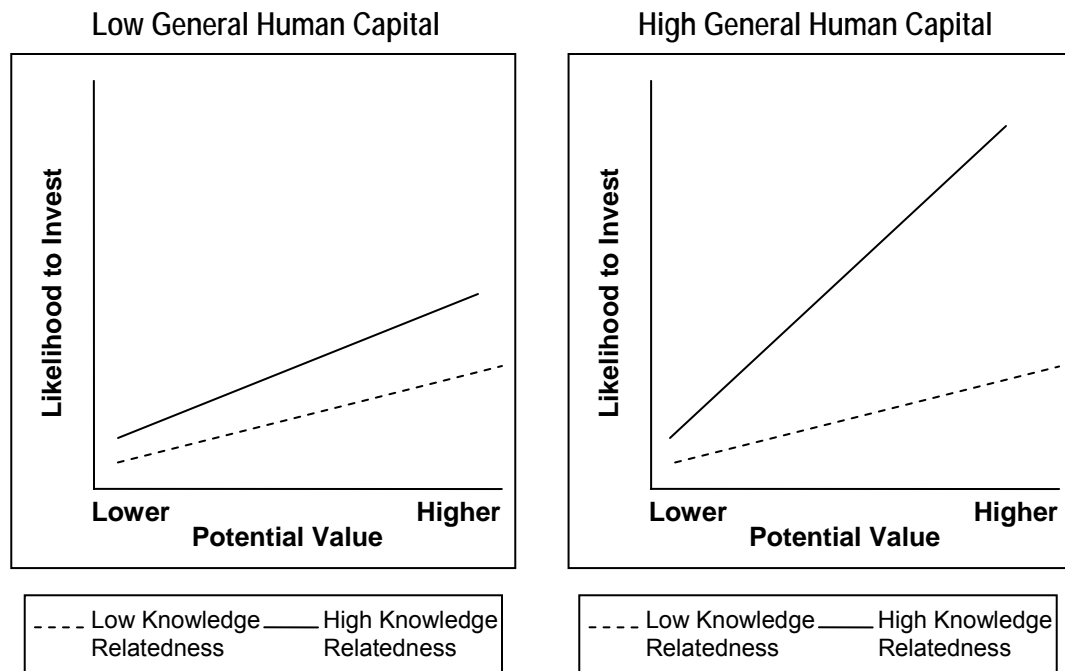


Figure 15, depicts the form of the effect that general human capital has on the hypothesized interaction between potential value and knowledge relatedness. It suggests that the positive relationship between potential value and likelihood to invest is enhanced more by knowledge relatedness when general human capital is high than when it is low.

**Figure 15: General Human Capital x Knowledge  
Relatedness x Value**



The lack of significant effects for industry experience, however, suggests a partial lack of evidence for proposition 3. In the discussion section I will attend to the implications of these proposition-related findings in more depth.

## **CHAPTER VI: DISCUSSION**

In two studies, I have addressed two primary research questions. The first research question addressed how entrepreneurs, who rely heavily on intuitive, procedural knowledge in their decision making, can transfer this knowledge; the second question asked how opportunity evaluation decisions are made by entrepreneurial decision makers and how these might differ between entrepreneurial decision makers. These two questions are fundamental to new enterprise development because their answers inform venture founding and growth processes that are, as yet, not completely understood in research and in practice.

I addressed the first research question through a field experiment that investigated the decision-policy consciousness of entrepreneurial decision makers in 127 technology companies. In support of extant theory, the results indicate that founders have lower decision-policy consciousness than non-founders, meaning that they are less able to articulate their intuitive procedural knowledge than non-founders. However, the results lend support to the proposition that knowledge codification can enhance decision-policy consciousness in general, but was more efficacious in affecting the decision-policy consciousness of founders versus non-founders.

I addressed the second research question through a conjoint study of the 127 entrepreneurial decision makers' opportunity evaluation decisions. These

results support extant theory on the factors that make up individuals' opportunity evaluation decisions. Specifically, as hypothesized, I found that increases in the potential value of an opportunity lead to a higher likelihood of investment. Similarly, the greater the knowledge relatedness of an opportunity, the more likely an entrepreneurial decision maker is to invest in that opportunity. In addition, I found that likelihood of investment based on the potential value of an opportunity increases at a faster rate when knowledge relatedness is higher versus when it is lower. This suggests the importance of joint consideration of both desirability (potential value) and feasibility (knowledge relatedness) in investigations about opportunity evaluation. In an interesting set of results, I also found that, entrepreneurial decision makers are more likely to invest in opportunities with wide, versus narrow, windows and are also more likely to invest when there are many, as opposed to few, opportunities to choose from.

Moreover, in study two I also found that differences in individual level factors affect entrepreneurial decision makers' decisions to invest in an opportunity. Specifically, I found that fear of failure affects the relationship between potential value and likelihood to invest such that a high fear of failure leads to a lower likelihood of investment for lower value opportunities relative to higher value opportunities. I also found that fear of failure also impacts the relationship between number of available opportunities and likelihood of investment in the sense that a high fear of failure results in a lower likelihood of investment when there are many opportunities to choose from relative to when there are few opportunities to choose from. The findings also suggest that

entrepreneurial self-efficacy impacts the effect of potential value on likelihood of investment such that the positive relationship between potential value and likelihood to invest is enhanced more by a high number of opportunities when entrepreneurial self-efficacy is low than when it is high. Lastly, I found that general human capital impacts the relationship between potential value and likelihood of investment in that high general human capital leads to a lower likelihood of investment for lower value opportunities relative to higher value opportunities. Additionally, I found that the positive relationship between potential value and likelihood of investment is enhanced more by knowledge relatedness when general human capital is high than when it is low.

In the following sections, I discuss the theoretical and practical implications of these findings (summarized in Table 10). I do this by first providing context for the findings and then discussing the potential contributions that flow from these findings. This is done for both study one and study two, in turn. I also discuss the limitations of both studies as well as future research directions.

**Table 10: Summary of Findings**

	<b>Hypotheses and Propositions</b>	<b>Support</b>
H1	Firm founders will have lower decision-policy consciousness than non-firm founders.	Supported
H2	Entrepreneurs who engage in knowledge codification will possess higher decision-policy consciousness than entrepreneurs who do not engage in knowledge codification.	Marginally supported
H3a	Entrepreneurs with high incentives to articulate knowledge about a specific decision policy will have higher decision-policy consciousness than entrepreneurs without high incentives to articulate a specific decision policy.	Not supported
H3b	Decision-policy consciousness about opportunity assessment will be higher for individuals whose incentives to articulate are framed in terms of a promotion focus (gains) than those whose incentives are framed in terms of a prevention focus (losses).	Not supported
H4	Entrepreneurs who use structurally similar analogies to describe their decision policies will possess higher decision-policy consciousness than entrepreneurs who do not use structurally similar analogies.	Not supported
H5a	Decision-policy consciousness about opportunity assessment increases as entrepreneurs engage in codification of their knowledge, but does so at a faster rate for founders than for non-founders.	Supported
H5b	Decision-policy consciousness about opportunity assessment increases as entrepreneurs' incentives to articulate knowledge about a decision policy increase, but does so at a faster rate for founders than for non-founders.	Not supported
H5c	Decision-policy consciousness about opportunity assessment increases as entrepreneurs receive incentives framed in terms of a promotion focus (gains), but does so at a faster rate for founders than for non-founders.	Not supported
H5d	Decision-policy consciousness about opportunity assessment increases as entrepreneurs utilize structurally similar analogies to describe their decision policies, but does so at a faster rate for founders than for non-founders.	Not supported
H6	The higher the potential value (desirability) of an opportunity, the more likely an entrepreneur is to invest in (act on) that opportunity.	Supported
H7a	The higher the knowledge relatedness (feasibility) of an opportunity, the more likely an entrepreneur is to invest in (act on) that opportunity.	Supported
H7b	The likelihood of investing in (acting on) an opportunity increases with the potential value (desirability) of an opportunity, but does so at a faster rate when knowledge relatedness (feasibility) of the opportunity is high.	Supported
H8a	The narrower the window of opportunity availability (environment), the more likely an entrepreneur is to invest in (act on) that opportunity.	Opposite Direction
H8b	The likelihood of investing in (acting on) an opportunity increases with the potential value of an opportunity, but does so at a faster rate when the window of opportunity availability (environment) is narrow.	Not supported
H9a	The fewer the number of potential opportunities available (environment), the more likely an entrepreneur is to invest in (act on) that opportunity.	Opposite Direction
H9b	The likelihood of investing in (acting on) an opportunity increases with potential value of an opportunity, but does so at a faster rate when the number of potential opportunities available (environment) is few.	Not supported
P 1	Entrepreneurs' opportunity evaluation decision policies will differ based on their attitudes about failure.	Supported
P 2	Entrepreneurs' opportunity evaluation decision policies will differ based on their perceived entrepreneurial self-efficacy.	Supported
P 3	Entrepreneurs' opportunity evaluation decision policies will differ based on their general human capital (educational experience) and specific human capital (industry experience).	Partially supported

## Implications for Theory

**Context of Study One.** In the introduction to this research study, I discuss a paradox related to individual expertise: as expertise increases, the ability to utilize this expertise decreases. This occurs as a result of knowledge proceduralization. An analogous paradox is discussed in the strategy literature (Coff, Coff, & Eastvold, 2006; Rivkin, 2001). At the level of the firm a knowledge resource is most valuable when it is tacit and thus cannot be copied by competitors (Barney, 1991; Dierickx & Cool, 1989); but at the same time, a tacit resource is also of limited use for a firm if it cannot be shared within that firm (Lippman & Rumelt, 1982).

Two notable approaches for resolving this paradox at the level of the firm have been presented in the literature. Rivkin (2001) suggested that a firm should balance the complexity of its knowledge. This is because at both high and low levels of complexity, a firm cannot derive maximum benefit from the knowledge resource: at high levels of complexity, the firm does not benefit from the knowledge because it is not replicable within the firm; and conversely, at low levels of complexity the firm does not benefit from the knowledge because it is imitable by competitors. In both cases the result is a loss of any advantage that the knowledge would have afforded. In theory, this approach has significant benefits: a firm with moderate levels of complexity in knowledge will outperform other firms with low and high levels of knowledge complexity because it can replicate its knowledge without it becoming imitable. In practice, however, this approach is difficult to implement. Specifically, as Rivkin rightly noted, although

the role of the individual has been largely simplified in his analysis, individual decision makers affect the level of complexity in knowledge; and the determination of proper levels of complexity is not an easy feat, particularly given variation in the external environment. Accordingly, a more complete picture (one that includes individual decision makers) is needed for this approach to be of use to individual decision makers.

Coff et al. (2006) provided a second perspective on the resolution of the knowledge paradox that gives greater consideration to the individual decision maker. To situate their resolution of the knowledge paradox, they noted that in undertaking the important task of scaling scarce knowledge resources, greater codification of knowledge is frequently required. But this, they said, is at the crux of the knowledge paradox: “in transferring and codifying knowledge to achieve the requisite scale, it may lose strategic properties that keep it from rivals (2006: 454).” Their response to this is to utilize information technology that does not codify knowledge, but that instead creates even more tacit knowledge while also increasing specialization related to use of that knowledge. This is achieved by allowing individual expertise to be utilized throughout a firm, without actually codifying the knowledge related to that expertise. They elaborated on what this might look like:

One might ask what type of technology might leverage those with tacit knowledge while minimizing the codification required. We begin with an example of tacit knowledge in the form of pattern recognition, where an expert can observe a set of stimuli, discern patterns, and translate them into recommendations (Simon, 1987). While this type of knowledge might be amenable to expert systems, were it codified and reduced to a set of decision rules, as discussed, that might reduce the strategic properties of the knowledge. However, technology might still be used to organize and



track information. This would leave the key task of spotting trends in the information uncoded. However, the information that a decision maker would use could be collected and displayed in an interface that facilitated interpretation. In this way, a decision maker could become more productive without codifying or transferring the most critical knowledge—how to interpret patterns in the data (2006: 458).

They suggested that in utilizing such information technology, firms can leverage knowledge while not reducing its strategic value. But, as will be explained in more detail below, this proposal has its limits: it is not well suited to leverage opportunity-related knowledge.

With respect to the above quotation, it is interesting to note that Coff et al. (2006) specifically viewed the codification of decision rules regarding a set of stimuli as negative. This is interesting since it is this very type of knowledge codification that is advanced in this research. Understanding the reasons that underlie these differences is important to understanding the contributions of this research. Specifically, differences between approaches can be found in the distinctiveness of opportunity-related knowledge vis-à-vis knowledge regarding current competencies within a firm.

First, unlike the knowledge underlying existing competencies where knowledge outcomes are understood, outcomes of opportunity-related knowledge are surrounded by ambiguity (Hill & Levenhagen, 1995). Second, because the value of the knowledge underlying an existing competency has already been demonstrated, the leveraging of this knowledge is typically supported by key stakeholders within the organization. This is not the case for opportunity-related knowledge; rather, because of the ambiguous and untested nature of this knowledge related to new opportunities, commitment from other

stakeholders is frequently difficult to obtain (Miller & Ireland, 2005). Third, the role of resources in utilizing the knowledge underlying an existing competency is different than the role of resources in utilizing opportunity-related knowledge. In the case of knowledge underlying existing competencies, resources are devoted to scaling up the knowledge underlying the competency (Coff et al., 2006); however, in the case of opportunity-related knowledge, resources must be invested in both the scaling up of the knowledge *and* the exploitation of the untested opportunity presented by that knowledge. In this sense, special consideration is needed for the paradox of entrepreneurial expertise beyond existing perspectives.

***Theoretical Contributions of Study One.*** An enhanced understanding of the differences between the knowledge underlying an existing competency and the knowledge underlying a new opportunity has broad implications. Specifically, the theory and findings of study one provide a resolution for the knowledge-scaling paradox in that they focus on different types of causal ambiguity as well as the mechanisms that can best leverage these different types of ambiguity. In the following paragraphs, I offer a number of ways in which the theory and findings of study one contribute to the literature.

#### New View of Entrepreneurial Knowledge

Taken together, the differences between knowledge underlying existing competencies and knowledge underlying an entrepreneurial opportunity indicate the importance of resolving the knowledge paradox in the entrepreneurial context. In the entrepreneurial context, the cost of not being able to articulate

knowledge related to expertise is high, particularly given the paucity of resources in entrepreneurial firms (Aldrich, 1999). Leveraging knowledge-resources in entrepreneurial environments can be crucial to both the early survival (Thornhill & Amit, 2003) and subsequent performance (Wiklund & Shepherd, 2003) of entrepreneurial firms. In this sense, an understanding of how to utilize knowledge without putting at risk the advantage to be gained from that knowledge is fundamental to the process of new enterprise development. In this research, such an understanding is gained by advocating an approach mirroring that of Rivkin (2001), but providing specific steps that individual decision makers can take. Instead of uni-dimensionally attempting to achieve moderate levels of complexity in knowledge, a multi-dimensional approach can be taken in which moderate levels of complexity in knowledge *on average* are achieved through a division of knowledge in terms of the expected benefit of knowledge articulation.

The two types of causal ambiguity cited in chapter one—characteristic ambiguity and linkage ambiguity (King & Zeithaml, 2001)—clarify the benefits that can be gained by a division of knowledge. Specifically, ambiguity about the attributes of a specific entrepreneurial opportunity represents characteristic ambiguity; and ambiguity about the relationship between a specific opportunity and value creation represents linkage ambiguity. Because linkage ambiguity has been found to be negatively related to performance (King & Zeithaml, 2001), the investigation within this study centered on ways to reduce ambiguity about the relationship between a specific opportunity and value creation without reducing ambiguity about the attributes of a specific entrepreneurial opportunity. In the

case of opportunity evaluation decisions, opportunity/value relationship ambiguity is due to the proceduralization of knowledge related to the opportunity decision (Mitchell et al., 2005). Because this intuitive, procedural knowledge is rooted in expertise, it has the potential to confer a competitive advantage insofar as it can be meaningfully and accurately articulated to other stakeholders (Hill & Levenhagen, 1995; Miller & Ireland, 2005). Thus, a division of knowledge can resolve the knowledge-scaling paradox once an understanding of the mechanisms that facilitate the reduction of linkage ambiguity—while preserving characteristic ambiguity—is gained. The identification that such a division is a potential course of action strikes at the foundation of the thinking processes that are fundamental to new enterprise development. The results of study one provide insight into the ways in which this can be done.

#### An Expanded View of Expertise and Intuition

The finding that founders possess lower decision-policy consciousness than non-founders informs previous research relating entrepreneurial expertise and entrepreneurial intuition (Crossan et al., 1999; Mitchell et al., 2005). First, the findings indicate marginal support that those who profess to use intuition do, in fact, have lower decision-policy consciousness than those who do not profess to use intuition. Moreover, the significant effect in hypothesis 1 illustrates that an increase in founder-related expertise is in fact related to a decreased consciousness of the knowledge related to that expertise, providing evidence for the knowledge proceduralization process (Gordon, 1992). This effect supports the theory put forward by Mitchell et al. (2005) in the sense that greater founder-

related expertise (what they term domain competence) results in greater entrepreneurial intuition.

### Understanding the Benefits of Knowledge Codification

The finding that knowledge codification does indeed increase decision-policy consciousness is important for a number of reasons. First, the applicability of knowledge codification has been criticized because of its associated costs (Zollo & Winter, 2002).<sup>26</sup> The results of study one suggest, however, knowledge codification can be beneficial with little cost to the entrepreneurial decision maker above the time required (which on average was less than six minutes). In this sense, blanket assertions that knowledge codification is an expensive undertaking are overly broad. While the costliness of codification of course depends on the knowledge that is being codified, in and of itself, codification need not be expensive.

Second, the marginal support for hypothesis 2 provides evidence that knowledge codification facilitates the articulation of intuitive procedural knowledge. This finding is of particular relevance to research on entrepreneurial intuition (e.g., Mitchell et al., 2005), in that it provides a key to opening the previously unopened black-box explanation for entrepreneurial outcomes. In the past, outcomes that have been ascribed to entrepreneurial intuition have been taken on faith alone. The results here, however, provide a mechanism for developing an understanding, albeit preliminary, of the internal workings of entrepreneurial intuition.

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<sup>26</sup> I hasten to note that while Zollo and Winter (2002) pointed to cost as a primary drawback of codification, the overall tenor of their article is that a strong case can be made for the benefits of codification.

A third benefit that is gained from the findings related to knowledge codification is that they may broaden our understanding of the Tacit-Articulate Knowledge Dimensions (see Figure 3). Specifically, Winter notes that “tacit skills may be teachable even though not articulable” (2003: 171). What the findings of study one may indicate is that the tacit-articulate continuum may actually be wider than previously thought. What was once considered tacit (and thereby not articulable) may actually be articulable. If what was once tacit in new enterprise development can be made explicit, then further advances in understanding the fundamentals in new venture formation are within reach. In particular, the finding that what has previously been “locked up” in entrepreneurs’ minds can actually be made accessible creates hope for achieving a better understanding of founding processes in new venture formation. Moreover, if the tacit-articulate continuum is wider as a result of knowledge codification, what was previously thought to be “not teachable” may, in fact, be “teachable.” This is a fruitful area for further research.

#### Dynamic Capabilities in Entrepreneurship

Dynamic capabilities have been defined to be “learned and stable pattern[s] of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness” (Zollo & Winter, 2002: 340). As has been previously noted, the processes whereby intuitive procedural knowledge is made transferable represent a potential dynamic capability for a firm (Winter, 2003) because skill at transferability processes can be used to develop and adapt other strategic

capabilities and routines (Zollo & Winter, 2002). Based on the findings in study one, knowledge codification can facilitate the creation of dynamic capabilities insofar as it facilitates diffusion of the knowledge related to a specific capability (Nonaka, 1994; Zollo & Winter, 2002). In this case, the capability is the knowledge related to the link between an opportunity and value. A dynamic capability is created insofar as an understanding of codification can be used to reduce linkage ambiguity across situations and circumstances.

Moreover, as Collis (1994) noted, because dynamic capabilities can always be superseded by higher-order capabilities, researchers should not simply extol the virtues of capabilities devoid of context, but should rather “generate lists of the enormous variety of capabilities and develop normative prescriptions for actually building those capabilities” in a particular temporal context (1994: 151). The findings of study one represent such a step. Specifically, the marginal support for hypothesis 2 suggests that codification facilitates the reduction of linkage ambiguity in the context of opportunity evaluation decisions; moreover, the findings related to hypothesis 5a suggest that this codification is more efficacious for founders than non-founders. Both instances provide evidence of contextual effects of a codification-based capability.

#### Measurement of Intuition

Cognitive constructs are inherently difficult to measure. This is because the processes that underlie the constructs being measured are not directly observable, but are only observable by their effects. This has been particularly

problematic from the standpoint of entrepreneurial intuition because theory progresses no faster than its propensity for measurement (Nunnally, 1978). Thus, while measures do exist for a number of other cognitive constructs in entrepreneurship (Baron & Ward, 2004), a useful measure of entrepreneurial intuition does not exist apart from self-report measures of intuition (e.g., Allinson & Hayes, 1996). And while such measures are useful in their own right, they are limited in the sense that these measures are susceptible to hindsight biases. Moreover, when self-report measures are used, intuition is not necessarily distinguished from false intuition (Covin & Blume, 2005).

Accordingly, it may be that the lack of theoretical development in the area of entrepreneurial intuition to date may be the result of inadequate measures. Thus, a major contribution of study one is the measurement of decision-policy consciousness, which resembles a measure of entrepreneurial intuition. As Mitchell, Friga and Mitchell (2005: 669) noted, measurement of entrepreneurial intuition must: (1) take into account the process dynamism of entrepreneurial intuition, (2) accommodate both conscious and unconscious processes, and (3) be applicable to the multiple sub-domains within which an opportunity can be identified. The measure of decision-policy consciousness does just this. First, the measure of decision-policy consciousness takes into account the process dynamism of entrepreneurial intuition in its reliance on the expertise of the entrepreneurial decision maker in a decision domain. Second, decision-policy consciousness measures both unconscious and conscious processes in the combined measurement of in-use and espoused effects. Lastly, decision-policy



consciousness controls for differences in (and is applicable to) multiple sub-domains insofar as it is measured in the context of an individual's current opportunities.

Moreover, the evidence presented in study one provides preliminary support for the assertion that decision-policy consciousness is a measure of entrepreneurial intuition in that professed use of intuition is marginally related to decision-policy consciousness (i.e., higher professed use of intuition corresponds with lower decision-policy consciousness), but entrepreneurial self-efficacy, general self-efficacy and overconfidence are not related to decision-policy consciousness (Covin & Blume, 2005). In this sense, the measurement of domain competence provides a measure for entrepreneurial intuition that can be used in the further development of entrepreneurship theory. This is important because intuition is frequently cited as a reason for entrepreneurial behavior (Agor, 1984; Block, 1990; Fox, 1981; Hayashi, 2001; Isaack, 1978; Klein, 2003).

#### Expertise- and Heuristic-based Decision Making

Research in entrepreneurial decision making has been approached from a number of different frameworks (e.g., Dickson & Giglierano, 1986; Eisenhauer, 1995; Sarasvathy, 2001). From a cognitive perspective, two stand out. Viewed through the lens of an expertise-based perspective, differences in entrepreneurial decision making is taken to be the result of differences in the knowledge structures of entrepreneurs (e.g., Gustafsson, 2004; e.g., Mitchell, 1994; Mitchell et al., 2000). Viewed through the lens of a heuristics-based perspective, differences in entrepreneurial decision making is seen to be the result of

differences in the use of various heuristics and biases (e.g., Busenitz & Barney, 1997; Simon & Houghton, 2003; Simon, Houghton, & Aquino, 2000). Both perspectives have been successful in explaining differences in entrepreneurial decision making, but it is unclear in the literature how the two perspectives relate. Indeed, some might suggest that the two perspectives are at two opposite ends of a spectrum—e.g., Baron and Ward’s question as to whether entrepreneurs prefer heuristic or systematic thinking (2004). The findings of study one address this gap in the literature and begin to situate both perspectives in the context of the opportunity evaluation decision.

As is described previously, the findings related to the effect of founder status on decision-policy consciousness suggest that those with greater firm-related expertise have lower decision-policy consciousness than those with lesser firm-related expertise. This finding is consistent with an expertise-based view of entrepreneurial decision making. Namely, differences in the decision-policy consciousness of founders compared to non-founders may result from differences in the knowledge structures possessed by founders compared to non-founders (Mitchell, 1994; Mitchell et al., 2000). In this sense, knowledge codification in opportunity evaluation decisions helps founders to leverage their expertise by assisting them to increase their decision-policy consciousness related to these decisions.

Similarly, an interesting effect is exhibited in the findings related to hypothesis 5a. Knowledge codification is found to benefit founders more than it benefits non-founders. The reasoning behind this effect is that founders tend to

utilize the representativeness heuristic more than others (a result of their assumptions about the link between information inputs and predicted outcomes), which allows them to economize on limited processing resources. However, because the process of codification challenges these assumptions, its effect is enhanced for founders compared to non-founders. In this sense, codification plays an important role. While use of the representativeness heuristic can be advantageous (Busenitz, 1999: 337), it also has its limits. As Baron noted,

Since entrepreneurs are, by definition, breaking new ground in terms of the products or services their companies provide, they must also engage in careful analysis of situations and events and formulate strategic plans (2004: 235).

Thus, knowledge codification can be viewed as a mechanism that regulates use of the representativeness heuristic.

Taken together, these results suggest that both expertise and heuristics play a similar role in facilitating entrepreneurial decision making through acceleration of the decision-making process—expertise through knowledge proceduralization and heuristics through decision-shortcuts—while also retaining their unique contributions to this process. Expertise is fundamental to achieving successful entrepreneurial outcomes (Mitchell et al., 2000), while heuristics are essential to decision making in fast-paced, high risk environments (Simon et al., 2000). But ironically, as the findings related to hypothesis 5a would seem to indicate, it is the tendency of founders to utilize heuristics-based processing more than others that increases the efficacy of knowledge codification in increasing decision-policy consciousness, thereby enabling them to benefit from their

expertise. In this sense, the absence of either heuristics or expertise can limit the usefulness of the other.

***Literature Related to Study Two.*** I had two aims in study two. First, I sought an increased understanding of the content of the opportunity evaluation decision policy; and second, I sought an enhanced understanding of how this decision policy differs between entrepreneurial decision makers. Key to both goals was entrepreneurial action. McMullen and Shepherd (2006) proposed two stages of entrepreneurial action: opportunity attention and opportunity evaluation. They suggested that opportunity attention involves questions of why opportunities are recognized and acted upon *in general* and that opportunity evaluation involves questions of why opportunities are recognized and acted upon *by specific individuals*. The primary focus of study two has been on the opportunity evaluation aspect of entrepreneurial action. As has been touched upon previously, perceptions of opportunity desirability and feasibility affect the decision to act on that opportunity through investment. In addition, the presence of uncertainty also affects the decision to act on an opportunity through investment (McMullen & Shepherd, 2006).

The reasons that likelihood of entrepreneurial action increases as desirability of an opportunity increases are self-evident. Indeed, as Shane and Venkataraman noted, “entrepreneurship involves the nexus of two phenomena: the presence of lucrative opportunities and the presence of enterprising individuals” (2000: 218). The value afforded by an opportunity is a necessary condition of entrepreneurial action because it compensates entrepreneurs for the

time, money and effort that are required to identify and exploit an entrepreneurial opportunity (Venkataraman, 1997). In an investigation of entrepreneurial discovery, Shane (2000) found that prior knowledge plays a central role. Specifically, he found that entrepreneurs discover opportunities that are related to the knowledge that they already enjoy. Relating this to the decision to act on an opportunity, an individual's belief that they have the requisite knowledge to successfully exploit an opportunity is linked to the intention to act on that opportunity (Krueger, 2000; Krueger & Brazeal, 1994). In this sense, prior knowledge leads to entrepreneurial action (McMullen & Shepherd, 2006). Perceptions of the opportunity environment also affect the decision to act; indeed, the uncertainty surrounding an opportunity (or set of opportunity alternatives) presents a decision-making challenge (Eisenhardt, 1989). But as McMullen and Shepherd noted,

The willingness to bear the perceived uncertainty associated with an entrepreneurial act is representative of a belief-desire configuration, in which belief of what to do is a function of knowledge and desire of why to do it is a function of motivation (2006: 148).

In this sense, an understanding of uncertainty is, to some measure, achieved through an understanding of the desirability and the feasibility of an entrepreneurial opportunity. And conversely, the desirability and feasibility of an opportunity can be better understood in the context of environmental uncertainty.

***Theoretical Contributions of Study Two.*** Entrepreneurs pursue opportunities that have higher potential value (Shane & Venkataraman, 2000). Said differently, increases in the desirability of an opportunity lead to increases in the likelihood of investment in that opportunity (McMullen & Shepherd, 2006).

This proposal is confirmed in the findings related to hypothesis 6, wherein an increase in the potential value of an opportunity is shown to increase likelihood of investment in that opportunity. As previously noted, this finding is self-evident, but necessarily investigated to facilitate an understanding of the other aspects of opportunity evaluation (because, as McMullen and Shepherd (2006) noted, desirability and feasibility must be considered in tandem). It is to these findings, and their respective contributions, that I turn.

#### Virtuous Circle of Knowledge

Knowledge is a valuable resource (Penrose, 1959). It is crucial to discovering opportunities (Shane, 2000); and, as is indicated in the findings related to hypothesis 7a, is crucial to the decision to act on these opportunities. This finding confirms the argument put forward by McMullen and Shepherd (2006) that the perceived feasibility of an opportunity increases an individual's likelihood to act on that opportunity.

In addition to demonstrating the importance of knowledge in entrepreneurial action, I find an important link between knowledge and value. The findings of hypothesis 7b suggest that likelihood of entrepreneurial action increases as value increases, but does so at a faster rate when knowledge relatedness is high than when it is low. This interaction between value and knowledge may represent the beginning of a virtuous circle. Specifically, when knowledge is high the likelihood of investing in a high value opportunity is increased. The application of this knowledge in the exploitation of the opportunity, in turn, can generate new knowledge (Leonard-Barton, 1995) which

then leads to the discovery and exploitation of new high value opportunities (McMullen & Shepherd, 2006; Shane, 2000). In the application-generation-discovery process, described in the previous sentence, is revealed the potential for a virtuous circle of knowledge. It appears that an understanding of this virtuous circle of knowledge might operate at the foundations of new enterprise development.

But there is a potential cost to invoking this virtuous circle of knowledge. The knowledge that we possess may be the very key to our undoing as new innovations that are unrelated to current knowledge make useless this current knowledge (Christensen, 1997; Schumpeter, 1942). How is it that this trend can be countered? This is where study one and study two merge. In their theory of action, Argyris and Schön (1974) talk of the importance of double-loop learning, which is distinguished from single-loop learning in its relationship to an external environment.

In single-loop learning, we learn to maintain the field of constancy by learning to design actions that satisfy existing governing variables. In double-loop learning, we learn to change the field of constancy itself (Argyris & Schön, 1974: 19).

This interaction between knowledge and value that is evident in hypothesis 7b represents the possibility of single-loop learning that is described as a virtuous circle of knowledge.

To achieve double-loop learning, however, Schön (1983; 1987) noted the importance of reflection-in-action. And as is previously noted, the process of knowledge codification (Zander & Kogut, 1995) is thought to facilitate such reflection (Zollo & Winter, 2002). As has been demonstrated, knowledge

codification can increase decision-policy consciousness in opportunity evaluation. In this sense, the single-loop learning that is evident in the interaction between value and knowledge in their effect on entrepreneurial action can be nudged toward a process indicative of double-loop learning through codification of the opportunity evaluation decision policy.

### Uncertainty, Risk and Action

The findings of study two suggest that window of opportunity availability is related to likelihood of investment, but in the opposite direction of what was hypothesized. Specifically, wider windows of opportunity availability are associated with an increased likelihood of investment. What this suggests is that entrepreneurs prefer investment under long-term uncertainty, over immediate certainty. This result may be due to a tendency of individuals to view each decision independent of other decisions. Indeed, Kahneman and Lovallo (1993) proposed that:

Overly optimistic forecasts result from the adoption of an inside view of the problem, which anchors predictions on plans and scenarios (1993: 17).

In this sense, the preference for opportunities with a wide, but uncertain, window may reflect a tendency to rely on opportunity-specific information (i.e., the value and the knowledge) while ignoring salient external information (i.e., the window of opportunity availability). Again, this fits with the proposition that the willingness to act in the face of uncertainty is due to perceptions of opportunity desirability and feasibility (McMullen & Shepherd, 2006).



## Environmental Munificence and Entrepreneurial Action

Similar to the findings related to window of opportunity availability, the relationship between number of potential opportunities and potential value was in the opposite direction of that which was hypothesized. Specifically, the greater the number of potential opportunities available, the more likely an entrepreneurial decision maker is to invest in an opportunity. As is noted previously, the number of alternatives in decision making has been found to be related to speed of decision making: faster decision making is associated with many alternatives, while slower decision making is associated with few alternatives. Moreover, slow decision makers tend to seek out new alternatives when old ones are no longer feasible (Eisenhardt, 1989). These findings may inform our understanding of the results in this study related to number of potential opportunities. Specifically, while the rationale behind hypothesis 9a focused on the individual's perceptions of an opportunity within an opportunity environment, it may be that the explanation lays in entrepreneurial decision makers' perceptions of themselves within an opportunity environment.

From this perspective, an environment with few potential opportunities may be seen as lacking resources and/or hostile to progress: an environment where scarce resources are best preserved. In contrast, an opportunity environment with many potential opportunities may be seen as munificent and wide open to new growth. Such environments are thought to attract new development and growth because they can *accommodate* such growth (Specht, 1993). Moreover, a munificent environment is thought to represent potential

knowledge flows, which positively influence performance (DeCarolis & Deeds, 1999). In view of this, the number of potential opportunities may represent prospective knowledge flows for an entrepreneurial decision maker. When there are many opportunities, the environment is perceived as munificent and is therefore an appealing place to operate. When there are few opportunities, however, an environment is seen as hostile and to be avoided.

In this sense, the choice to pursue opportunities in environments with many other opportunities represents an attempt to increase knowledge stocks by being open to new knowledge flows (Dierickx & Cool, 1989). Thus, in spite of having (1) more alternatives than can be pursued, (2) increased competition as a result of a munificent environment (Specht, 1993), and (3) increased complexity in decision making, the benefit of new knowledge flows that results from operating in munificent (high opportunity) environments is seemingly well worth it in the minds of entrepreneurial decision makers.

***Contributions of the Propositional Findings.*** As Shane and Venkataraman (2000) noted, in the decision to exploit entrepreneurial opportunities individual differences matter. In a series of three propositions, I investigated how individual differences affect entrepreneurial decision makers' decisions about entrepreneurial opportunities. Specifically, I explore how fear of failure, entrepreneurial self-efficacy, and human capital affect the opportunity evaluation decision and highlight the contributions of these findings.

## Fear of Failure

As is described in the results section, fear of failure significantly influences the effect of both potential value and number of potential opportunities on the likelihood to invest. Those with a high fear of failure are less likely to invest in opportunities with low value than those with a low fear of failure, but are equally likely to invest in higher value opportunities. This would seem to make sense. Those with a high fear of failure will tend to preserve resources when the value of an opportunity is low, rather than risk failure in pursuit of that opportunity. But when value is high, the benefits outweigh the costs. An irony, however, is presented in the findings relating to fear of failure and the number of potential opportunities in an environment. While equally likely to invest in an opportunity when few are available, those with a high fear of failure are less likely to invest in an opportunity when many are present. As described previously, environments with many available opportunities may be viewed as munificent. Thus, while they are equally likely to pursue high value opportunities as those with a low fear of failure, those with a high fear of failure are less likely to seek out high value environments. To add insult to injury, environments with many opportunities are the safest bets because they provide fallback positions; if one alternative fails, there are other alternatives from which to choose (Eisenhardt, 1989).

So what might explain these results? One possibility is that the high-fear-of-failure entrepreneurial decision maker is more likely to become overwhelmed by the number of alternatives in a high velocity environment (Damrad-Frye & Laird, 1989; Eisenhardt, 1989): those with a high fear of failure may be overly

deliberate in their actions about opportunities because to do otherwise may be overwhelming. In this sense, the findings here may provide additional insight into the findings of Eisenhardt (1989). Her analysis focused on the differences between fast and slow decision making, finding that fast decision makers evaluate more opportunities than slow decision makers. The results of this study may answer an unanswered question in her study: why do some individuals look at many opportunities and others look at few? The answer may lie in fear-of-failure differences.

#### Entrepreneurial Self-efficacy

The result regarding differences in entrepreneurial self-efficacy is interesting for two reasons. First, it is interesting because it is a significant between-individual effect on a non-significant within-individual effect. That is, while there is not a significant interaction effect between number of potential opportunities and potential value on likelihood to invest for the sample as a whole, entrepreneurial self-efficacy does significantly impact the interaction between these two variables. The second reason that this effect is interesting is found in the result that the positive relationship between potential value and likelihood of investment is enhanced more by a high number of opportunities when entrepreneurial self-efficacy is low than when it is high (see Figure 13). Relating this to the previous discussion regarding environmental munificence, potential value is more important in munificent environments to those with low entrepreneurial self-efficacy than those with high entrepreneurial self-efficacy.

Thus, it might be that those with low entrepreneurial self-efficacy do not believe that they can extract higher value in low-munificence environments and as a result only invest when munificence is high; whereas those with high entrepreneurial self-efficacy do believe that they can extract higher value in either environment. In other words, those with low entrepreneurial self-efficacy are influenced more by environmental factors than those with high entrepreneurial self-efficacy. As Boyd and Vozikis noted in their discussion of entrepreneurial self-efficacy:

A sense of personal efficacy that is both accurate and strong is essential to the initiation and persistence of performance in all aspects of human development (1994: 74).

But it may be that it is not the sense of self-efficacy alone that is essential to performance, but also the interaction between the sense of self-efficacy and the “aspects” of the environment that are essential. In this sense, future research should investigate the potential interaction between entrepreneurial self-efficacy and environmental factors, particularly the munificence of the environment. Such an investigation could extend previous research that highlights the importance of person–entrepreneurship fit (Markman & Baron, 2003), by increasing our understanding of person–entrepreneurship–environment fit.

### General Human Capital

As described in the previous analysis, there is partial support for Proposition 3. General human capital is shown to have a significant effect on the relationship between potential value and likelihood to invest. Specifically, compared to those with high general human capital, those with low general

human capital are more likely to invest in opportunities with lower value; but for opportunities with higher value, those with low general human capital are equally likely to invest as those with high human capital. This is an interesting finding because it runs counter to previous research findings which suggest that those with a high general human capital are most likely to pursue entrepreneurial opportunities (Reynolds, 1991: 63).

There are a number of potential explanations for this finding. The first is that the experience of overcoming the hurdles to business entry (e.g., through founding) may make those with low general human capital better able to recognize the *value* of *value*. In their minds, when they recognize an opportunity that has value (albeit not as much as other opportunities) *and they know something about* the opportunity, why not pursue it. It may be that such a mentality is what led them to be successful in the first place. A second explanation is that those with high education may be better able to recognize the risks associated with low value opportunities. Because of their training, they know what to avoid.

Third, the finding that the impact of high knowledge on the importance of value is greater for those with high levels of general human capital than for those with low levels of general human capital (see Figure 15) may suggest that perceptions of how to best apply knowledge in the pursuit of opportunities might differ between those with low levels of general human capital and those with high levels of general human capital. It may be that those with high levels of human capital recognize what they know and recognize how important this knowledge

actually is. They may see knowledge as best applied in high value situations wherein it can generate new knowledge related to high value opportunities (Leonard-Barton, 1995). In this sense, those with high levels of general human capital may recognize virtuous circles of knowledge to a greater degree than those with low levels of general human capital. Given the variety of potential explanations for these effects, additional research is needed.

### Individual Differences

In her work questioning the questions that are asked in entrepreneurship research Sarasvathy (2004) suggested a refocusing of efforts in entrepreneurship research. She proposed:

Instead of classifying individuals as entrepreneurs and nonentrepreneurs, we might want to create a taxonomy of categories within entrepreneurs. Each category would be homogenous along certain parameters and heterogeneous along others, allowing us then to look within each subcategory for similarities and also differences between categories in specific aspects of entrepreneuring, such as opportunity formulation, financing strategies, failure management, and so on. Therefore, instead of trying to relate characteristics across a variety of entrepreneurs (e.g., self-efficacy) with performance, we would be relating specific subcategories with specific aspects of performance (2004: 712).

In my exploration of Propositions 1-3, I have attempted, in part, to enact her call.

In particular, I have sought to understand *how* differences between

entrepreneurial decision makers lead to differences in their decisions to exploit opportunities to create new value (Shane & Venkataraman, 2000). While only a preliminary step, a number of interesting differences have been found to exist.

Obviously, this investigation was merely exploratory; but what the results suggest is that there is a need (and a reason) to undertake additional research on differences between entrepreneurs.

## **Limitations and Future Research Directions**

Of course, no study is without limitations. Within this section, I discuss the limitations of this study and link them to the yet unanswered questions that they imply. This is then followed by a general discussion of the future research directions that flow from this research.

First, because this research is a true field experiment, it has high external validity/generalizability (Campbell & Stanley, 1963; Cook & Campbell, 1979). However, because the research participants were entrepreneurial decision makers at technology companies in one geographical area, true generalizability of the results is limited to these types of companies in one geographical area. Thus, future research should seek to understand: (1) whether the mechanisms to transfer intuitive, procedural knowledge in opportunity evaluation decisions apply in multiple industries and multiple geographical areas; and (2) how the specific content of the opportunity evaluation decision differs between entrepreneurial decision makers. To answer these questions, future research can be designed to test hypotheses 1-9 in other industry contexts and settings.

Second, because of the experimental nature of study one, error variance is controlled through random assignment to experimental conditions. Compared to laboratory experiments, however, field experiments are less able to control for confounding effects. In this sense, the field experiment provides a stronger test of the hypotheses, but also means that significant effects may go undetected. Therefore, a better understanding of the mechanisms described in hypotheses 2-4 might be developed through investigating whether knowledge codification,



presence of decision communication incentives and use of analogy will affect decision-policy consciousness in a laboratory setting. While the generalizability of such an investigation will be limited, the internal validity of the resulting effects may provide greater insight into the mechanisms that are hypothesized to affect decision-policy consciousness.

Third, the decision communication incentive manipulation may not be strong enough to stimulate the hypothesized effects. Namely, this manipulation may not represent the high-stake incentives that are thought to motivate entrepreneurial decision makers (e.g., hypothesis 5b, which asserts that founders are likely to be influenced by the manipulation more than non-founders). Additionally, because of low reliability in the regulatory-focus manipulation check, it is unclear whether the decision communication incentive manipulation actually manipulates entrepreneurial decision makers' situational regulatory focus. In this sense, it is uncertain whether the lack of significant findings related to situational regulatory focus is due to the manipulation itself, or whether it is due to other confounding factors. Accordingly, before the impact of decision communication incentives on decision-policy consciousness can be adequately researched, additional work is needed to verify the efficacy of the associated experimental manipulations.

Fourth, conjoint analysis is limited in the number of profiles that individuals can manage. As the number of attributes increases, the number of profiles that individuals are required to evaluate also increases (Hahn & Shapiro, 1966); this results in biased responses on the part of decision makers (Green & Srinivasan,

1990). Thus, in addition to using an orthogonal fractional factorial design, only four attributes were included in study two in an attempt to make the task more manageable. One drawback of this approach is that it requires individuals to simplify aspects of a complex process. For instance, in study two entrepreneurial decision makers were asked to make a series of assumptions regarding the opportunity profile: they had access to the resources; the opportunity was similar to other opportunities they see, etc. But interesting research questions went untested due to the limitations of the technique. Thus, future research can investigate other aspects of the opportunity evaluation decision that could not be tested in this study. For example, future research can investigate how opportunity evaluation decisions are made in environments requiring resource tradeoffs; and how might individual differences influence the resulting decisions.

Fifth, this research has investigated how intuitive, procedural knowledge can be articulated such that it can be a resource to a firm. Taking direction from Mitchell et al. (2005), this has been done in the context of an opportunity evaluation decision because this decision is frequently described as being intuitive (e.g., Block, 1990). However, not all intuitive procedural knowledge relates to decisions about opportunities. Indeed, because procedural knowledge is based on expertise (Mieg, 2001), other types of expertise-based decision making may be worthwhile to pursue. In this sense, it is worth asking whether similar mechanisms increase the decision-policy consciousness of procedural knowledge in other decision-making contexts.

Sixth, as is noted previously, the investigation of the propositions related to differences between entrepreneurial decision makers' opportunity evaluation decision policies has been exploratory. While exploratory research is beneficial in management research (Bettis, 1991), it only represents a first step. Hence, as a next step, future research should seek to replicate the exploratory findings reported here in order to increase understanding about the differences between entrepreneurial decision makers.

Lastly, one of the key outcomes of management research is the explanation of why some firms outperform others (Hitt, Ireland, & Hoskisson, 2006; Rumelt, Schendel, & Teece, 1991). And while there are significant performance implications for this research, differences in performance were not explicitly investigated. Thus, the relationship between decision-policy consciousness in opportunity evaluation decisions and greater performance remains purely theoretical. In this sense, additional research should seek to address: (1) how reductions in linkage ambiguity related to opportunity evaluation decision (through increasing decision-policy consciousness) affects the exploitation of an opportunity, and the overall performance of a firm; (2) what effect increasing decision-policy consciousness (reducing use of intuitive, procedural knowledge) has on the exploration and exploitation of future opportunities; and (3) whether transferring codified knowledge about an opportunity evaluation decision leads to better exploitation of opportunities throughout a firm. Each of these questions represents a crucial link to

understanding how the cognitive aspects of opportunity evaluation affect entrepreneurial performance (Mitchell et al., 2002).

In addition to addressing the above limitations, future research should give additional consideration to the processes that lead to lower decision-policy consciousness. While linked to expertise, it is unknown whether there are other factors that moderate the relationship between expertise and decision-policy consciousness. It may be that an increased understanding of the processes whereby decision-policy consciousness is formed can further increase understanding of the mechanisms that enhance decision-policy consciousness, thereby enlarging our understanding of when and how decision-policy consciousness should and can be increased.

Further research should also address the relationship between decision-policy consciousness and other cognitive constructs. Following Sarasvathy (2004), future research is needed that addresses the effect of differences between entrepreneurial decision makers on decision-policy consciousness. Such an examination can increase understanding about performance differences between entrepreneurs, barriers to pursuing opportunities, and so forth; but will also situate the construct of decision-policy consciousness—as well as the construct of entrepreneurial intuition—in the broader nomological net (Peter, 1981; Schwab, 1980) of entrepreneurial cognition research.

Lastly, it is also important that further research consider the effect of firm and environmental factors on decision-policy consciousness. Indeed, as Covin, Slevin and Heeley (2001) found in their investigation of decision-making style,

firm structure and environmental technological sophistication, the effect of the decision-making style/firm structure interaction on performance differed depending on the environmental technological sophistication. A similar effect might be expected when considering decision-making differences between entrepreneurial decision makers with respect to decision-policy consciousness. It may be that both firm and environmental considerations impact the effect that decision-policy consciousness has on performance.

### **Implications for Practitioners**

As Kurt Lewin remarked: “there is nothing so practical as a good theory” (1951: 169).<sup>27</sup> Thus, having acknowledged the limitations of this research, there still remain a number of very practical implications for practitioners. First, in revealing a process whereby entrepreneurs can better articulate their tacit knowledge, the findings of this research study suggest how the ventures they create can proceed along a new enterprise development pathway with a clearly demarcated set of growth milestones. This field experiment with 127 entrepreneurial decision makers in high potential ventures provides a practical solution to the paradox of expertise in entrepreneurship. Through codification of their knowledge, entrepreneurial decision makers can articulate their intuitions about potential opportunities to create new value. In so doing, they can gain access to critical resources from stakeholders who might otherwise withhold resources due to high ambiguity about the link between an opportunity and performance.

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<sup>27</sup> Some attribute this to James C. Maxwell, a Scottish physicist who lived from 1831-1879.

Second, this research has practical implications for resource providers. Specifically, it suggests that founders and non-founders differ in their ability to articulate their knowledge, and accordingly that they differ in their ability to deliver on their resource promises. And as Will Rogers is said to have remarked: “it isn’t what you don’t know that hurts you; it’s what you know that ain’t so.” Armed with knowledge about the impact of knowledge codification on the articulation of opportunity evaluation decisions, resource providers can help entrepreneurial decision makers to understand and articulate their intuitions so that they are known to others, and thereby these “others” can make better investment decisions. Moreover, by understanding the differences between founders’ and non-founders’ ability to articulate knowledge, resource providers can then customize their own interactions with entrepreneurial decision makers according to their founder status.

A third implication of this research for practitioners, which makes intuitive, procedural knowledge measurable, is that such knowledge can be portrayed to others in credible terms. For years, this has been one objective of teaching and research in entrepreneurship. To accomplish this objective we, as a field, have: listened to war stories, promoted heroic lectures, invited guest speakers, and read hundreds of popular-press books. We have gained much from these activities, but credibility has always been a lurking issue. In this sense, the credible portrayal through this research of intuitive, procedural knowledge represents a very firm next step forward in our capability to more accurately and usefully benefit from the experiences of those who have “done it.”

A fourth implication of these research results is that they provide entrepreneurial decision makers with a workable tool to leverage their resources through policy and procedure specification and dissemination. Specifically, once understood, knowledge codification can lead to the creation of the organizational and structuring documents and systems that are the foundation of replicable routines within a new venture (Nelson & Winter, 1982). This creation process is literally the basis for injecting new dynamic capabilities into new enterprise. That is, entrepreneurial decision makers who understand how to benefit from knowledge codification in one area of new enterprise development (i.e., opportunity evaluation) can then replicate these new routines for articulation in other areas of expertise-based decision making.

A fifth implication that these results suggest to practitioners is that they can assist in the management of their individual beliefs vis-à-vis opportunity evaluation. This means they can calibrate their thinking (Kruger & Dunning, 1999). By understanding the effects of fear of failure and self-efficacy on decisions to invest in opportunities, individual entrepreneurial decision makers can leverage these beliefs when they are beneficial to the overall outcome (e.g., high self-efficacy when opportunities are few) and mitigate these beliefs when they are detrimental (e.g., high fear of failure when opportunities are many).

## **CHAPTER VII: CONCLUSION**

Within this study, I have addressed a number of gaps in the literature.

The first gap relates to a paradox of expertise: as expertise increases, the ability to utilize this expertise decreases. Viewed from different perspectives, the lack of transferability of this expertise can be viewed as either positive or negative.

From a resource-based vantage point, this lack of transferability is beneficial because the expertise is protected from imitation (Barney, 1991; Dierickx & Cool, 1989). An alternative view, however, is that lack of transferability reduces a firm's ability to generate rents as a result of factor immobility (Lippman & Rumelt, 1982). At the root of these opposing views is differences in types of causal ambiguity (King & Zeithaml, 2001). And while previous research has attempted to reconcile the two views in general (Coff et al., 2006; Rivkin, 2001); none have adequately addressed the paradox of expertise in entrepreneurial environments where causal ambiguity is thought to be high (Hill & Levenhagen, 1995).

Thus, a primary theoretical contribution of this research is in its reconciliation of the conflicting views with respect to entrepreneurship.

Specifically, I attempted to resolve the paradox of entrepreneurial expertise by addressing the ways that ambiguity about the relationship between a specific opportunity and value creation can be reduced, because reductions in ambiguity about how a competency is linked to competitive advantage have been shown to be positively associated with performance (King & Zeithaml, 2001); and because



hard-to-communicate decisions about entrepreneurial opportunities are thought to be based in entrepreneurial expertise (Mitchell et al., 2005).

Empirically, I addressed the linkage ambiguity gap in the entrepreneurship literature through an investigation of entrepreneurial decision makers' decision-policy consciousness. Decision-policy consciousness represents the extent to which individuals can articulate their intuitive, proceduralized expert knowledge. Because intuitive, proceduralized expert knowledge is thought to be the result of expertise, it was hypothesized that firm-founders would have lower decision-policy consciousness than non-firm founders. In other words, firm founders were expected to be less able to articulate their procedural knowledge related to opportunity evaluation. Consistent with this expectation, the findings support this hypothesis: firm founders exhibited lower decision-policy consciousness compared to non-firm founders. In this sense, firm founders are thought to be more intuitive in their decision making than non-firm founders.

I drew on the strategic capabilities and organization learning literatures to propose three mechanisms that were expected to increase decision-policy consciousness (i.e., reduce ambiguity about the relationship between a specific opportunity and value creation): knowledge codification, decision communication incentives, and use of analogy. The first of these, knowledge codification, was found to have a marginally significant effect on decision-policy consciousness. Moreover, knowledge codification was found to be more efficacious for founders than for non-founders. The insignificant effects of the other mechanisms may either be due to confounding effects in the field experiment setting, or to weak

operationalizations of the constructs. As is previously noted, additional research is necessary to understand the lack of significant effects of these variables on decision-policy consciousness.

A second gap in the literature that I addressed in this research was a lack of empirical research on the opportunity evaluation decision. Specifically, McMullen and Shepherd (2006) noted that the decision to act on an opportunity is distinct from the identification of that opportunity. Opportunity evaluation involves the decision to act and is the result of perceptions of opportunity desirability and feasibility. In a conjoint study—and in the context of a larger experiment—I investigated the content of the opportunity evaluation decision policy and found that desirability and feasibility do indeed combine in their effect on the decision to act. Moreover, I found that the environmental effects also influence this decision to act, but do so in an unexpected manner. That is, entrepreneurial decision makers are more likely to invest in an opportunity when: (1) there are not any external forces pushing them toward investment; and (2) there are many other opportunities available to invest in.

A third gap in the literature that I address in this study is suggested by Sarasvathy (2004). Specifically, she noted that there are different categories of entrepreneurs that need to be investigated. By understanding the differences between entrepreneurs, she suggests, we can better understand when and how facilitation of entrepreneurship will be beneficial. Thus, within this study I explored a number of factors that are thought to differentially affect entrepreneurial decision makers' opportunity evaluation decisions. The findings

indicate that fear of failure, entrepreneurial self-efficacy and general human capital each have some bearing on the decision to invest in an opportunity. Consistent with Sarasvathy (2004), these findings suggest a need for additional theorizing and exploration of differences between entrepreneurs.

In light of these findings, this research contributes to a variety of literatures. First and foremost, this research adds to the entrepreneurial cognition literature both theoretically and empirically. Theoretically, it contributes in the suggestion that at the root of opportunity-related intuitive, procedural knowledge there is negative ambiguity that can be reduced. Empirically, it contributes in the measurement of decision-policy consciousness, capturing the degree to which an entrepreneurial decision maker exhibits entrepreneurial intuition. It also contributes empirically to the entrepreneurial cognition literature in the finding that founders exhibit lower decision-policy consciousness than non-founders, providing evidence for the suggestion that entrepreneurial intuition is, in part, proceduralized entrepreneurial expertise. A third contribution of this research to the entrepreneurial cognition literature is that it has empirically demonstrated the content of the entrepreneurial evaluation decision policy, while also establishing the differences that exist between entrepreneurial decision makers in their individual decision policies. This research also contributes to the strategic capabilities literature in the empirical findings related to knowledge codification; specifically, that at the level of the individual, knowledge codification can be beneficial with little investment of resources.

Einstein is said to have remarked: “The only real valuable thing is intuition.” While not limiting my view of value to intuition alone, with this research, I have nonetheless attempted to reconcile a paradox that limits the value of intuitive knowledge in entrepreneurial decisions. The findings reported herein, particularly with respect to knowledge codification, represent a step toward understanding how to better leverage the value of intuitive knowledge—both for theory and for practice.

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## **APPENDICES**

### **APPENDIX A – Interview Guide**

#### **Goal One – Industry Opportunity environment**

- How would you describe your industry?
- How would you define the overall availability of opportunities in your industry?
- How might opportunities differ in your industry?

#### **Goal Two – Approach to opportunities and Opportunity Evaluation**

- How would you define an entrepreneurial opportunity?
- In your view, where do entrepreneurial opportunities come from? Are they created? Or are they found?
- How do you know that something is an opportunity?
- Do you differentiate between [recognizing/finding/creating] an opportunity and deciding to invest in an opportunity? If so, how?
- What is it that you do to [recognize/find/create] specific opportunities?

#### **Goal Three – Opportunity Evaluation**

- What kind of factors do you consider when deciding whether or not to invest in a specific opportunity? Describe this process? [With this question, if theoretically important concepts are suggested, rephrase the response to see if theory is consistent with the ideas of the entrepreneur; conversely, if concepts are suggested that go against theory, ask for explanation and clarification.]
- What else do you consider? [Repeat until a fairly exhaustive list is obtained.]
- How would you describe the choice to invest in a specific opportunity [when it is chosen from a set of potential opportunities]? How would talk about these potential opportunities? What would you do to describe them to others?
- How do you communicate your decisions to others? What is their response?
- When evaluating opportunities, would you say that you have a number of opportunities you are considering? Or do you tend to focus on one opportunity at a time? What does this involve?
- Do opportunities that you may not decide to pursue stick around? Or are they fairly short-lived? What is it that shortens or lengthens this lifespan? Do you ever abandon opportunities? If so, why?

- Do you usually consider the cost of investing in an opportunity? Or do you focus more on the benefits that can come from investment in an opportunity?
- How would you describe any uncertainty that must be dealt with when deciding to pursue a specific opportunity?

#### **Goal Four – Approach to Failure**

- How do you define failure when thinking about entrepreneurial opportunities?
- Have you previously had an entrepreneurial failure?
- What is the role of failure in the pursuit of opportunity

## **APPENDIX B – Recruitment Materials**

### **Appendix B1. Recruitment Letter 1**

Dear *Name*,

I am writing to solicit your support for a study currently being developed at Indiana University's Kelley School of Business. The purpose of the study is to develop a practical model focused on understanding how individuals evaluate, assess and communicate the potential of business opportunities.

This is important research, as the goal of the project is to develop a framework that we can take into the classroom and present to our entrepreneurship students as a tool for assessing the viability/potential of business opportunities.

As a resident of Indiana, you are undoubtedly aware of our status as one of the elite business schools nationwide, with entrepreneurship being a particularly strong program. It is because of research programs such as this one, where the research goals focus both on academic inquiry and on real, tangible benefits for how we teach, that our entrepreneurship program has received national recognition.

With this letter, I have enclosed a letter of introduction from Rob Mitchell and Professor Dean Shepherd, as well as more specific details about their request to help with the research. Rob and Dean are leading this research effort. I ask that you take 45 minutes and help them in this research effort. Doing so will go a long way toward furthering the progress we have already made toward realizing excellence in entrepreneurship teaching and research in business schools.

As always, thank you for your support.

Dr. Donald F. Kuratko  
*The Jack M. Gill Chair of Entrepreneurship*  
*Professor of Entrepreneurship & Executive Director*  
*Johnson Center for Entrepreneurship & Innovation*

## **Appendix B2. Recruitment Letter 2**

Dear *Name*,

We are writing to solicit your help as part of a study being conducted at the Kelley School of Business at Indiana University. The purpose of the study is to understand how individuals make and communicate decisions about potential business opportunities.

This research represents an important step toward our goal of being able to deliver a practical, first-class education in business and entrepreneurship to the students at the Kelley School. This research is special in that one of our primary goals is focused on improving how we teach entrepreneurship to our undergraduates and MBA students, and by participating in this study you will directly further that goal.

Based on our research, we have identified a small group of individuals whose level of expertise and experience qualifies them to participate in this study. Please note that this was not simply a mass mailing, but quite the opposite in that you were identified and selected to participate in this study based on your unique background and experience. Given the small number of qualified individuals, we sincerely hope you will participate in this study.

This study will focus on your approach to potential business opportunities and will take approximately 45 minutes to complete. We will call in a few days to see if it is possible to set up a time for us to meet and for you to participate in the study. Should you have any questions about the study, please do not hesitate to contact Rob Mitchell at 812-855-8666, or by email at [jrmitch@indiana.edu](mailto:jrmitch@indiana.edu).

Thank you in advance for helping us further excellence in business and entrepreneurship education at Indiana University. We look forward to talking with you further.

Rob Mitchell  
PhD Candidate  
Kelley School of Business  
Indiana University

Dean Shepherd  
Associate Professor  
Dean's Research Fellow  
Kelley School of Business  
Indiana University



### Appendix B3. Follow-Up Phone Script

Hello, may I speak with Mr./Ms. BLANK?

Mr./Ms. BLANK, this is Rob Mitchell from Indiana University. Dean Shepherd and I recently sent you a letter inviting participation in a series of interviews as part of my dissertation research. Did you receive this letter?

[YES]

Great. Have you had a moment to consider this request?

[NO]

Do you have a moment for me to explain this?

[YES]

Are you willing to participate in this study?

[NO]

When would be a good time to call back?

[YES]

Thank you.  
[Recite first 3 paragraphs from the previous letter].

[NO]

When would be a good time to call back?

[YES]

When would work for you?

Are you willing to participate in this study?

[NO]

Thank you for your time.

[YES]

When would work for you?

[NO] Thank you for your time.

For those that answer yes to the interview, I will then set up a time and a place for the interview, will answer any other questions that they may have and then end the phone conversation.

For those that are not able to talk at this time, I will set up another time to call, at which time I will re-use the above script to assess willingness to participate.

## APPENDIX C – Verbal Protocol

Experimenter: The purpose of this study is to evaluate how individuals make decisions on whether or not to pursue opportunities. As part of this participation, I am required by Indiana University to have you initial and sign a consent form affirming that you understand important information about the study. Will you please take a moment to read over this and sign it?

[Experimenter gives participant a copy of the consent form.]

[Participant reads and signs consent form.]

Experimenter: As the head of a company in a technology-related industry, you are ideally qualified to make decisions about whether or not to invest in potential opportunities. The first activity that we will do involves these decisions. I have here a copy of the instructions for this activity. Please read the instructions carefully and ask me any questions that you may have. Please also carefully read the definition of terms on the front page.

[Experimenter gives participant a copy of the: Study Instructions with the Descriptions of Terms and waits for participant to respond and ask any questions.]

Participant: [Response.]

[Experimenter answers any questions the participant may have.]

### **High/promotion-focus incentive condition**

You should do very well.

### **High/prevention-focus incentive condition**

You shouldn't do poorly at all.

### **Low incentive condition**

[No response].

Experimenter: To make this activity go faster, we will use a computer. This first section should take about 8 minutes.

[Experimenter enters the correct condition for the subject—low codification (1) or high codification (2)—and places the computer in front of the participant.]

Experimenter: In order to help you become familiar with the task, the first profile that you will be presented is a practice profile. Feel free to ask me any questions you may have.

[Experimenter watches the participant fill out the practice profile.]

### **High/promotion-focus incentive condition**

Well done!

### **High/prevention-focus incentive condition**

Not bad!

### **Low incentive condition**

[No response].

## Experimental Protocol

Experimenter: Please let me know when you are finished.

Participant: [Finishes the nineteen profiles and then responds.]

Participant: [Response.]

[Experimenter looks at the computer and then responds.]

### **High/promotion- focus incentive condition**

Perfect!

### **High/prevention- focus incentive condition**

Not bad at all!

### **Low incentive condition**

[No response].

Experimenter: There are some additional questions to ask about your decisions.

[Experimenter refers to the first page of Evaluation Form A and verbally asks the participant the questions on the form.]

Participant: [Response.]

### **High/promotion- focus incentive condition**

Experimenter: You did a great job, well done. This is going marvelously and will be very helpful to my research. Thank you for your help. Let's move on to the second part of the study.

### **High/prevention- focus incentive condition**

Experimenter: Not bad at all. I don't think this will spoil my results. Thank you. Let's move on to the second part of the study.

### **Low incentive condition**

Experimenter: Let's move on to the second part of the study.

[The experimenter begins to remove the codification materials from container they are carried in and begins to place them on the table/desk.]

**High/promotion-focus incentive condition**

Experimenter: What we are going to do now is quite important. It is the focus of the study, the part that I am most interested in and the part where you can help the most. I am going to ask you additional questions about these investment decisions.

**High/prevention-focus incentive condition**

Experimenter: What we are going to do now is quite important. It is the focus of the study, the part that I am most interested in and where I need you to be most careful. I am going to ask you additional questions about these investment decisions.

**Low incentive condition**

Experimenter: I am going to ask you additional questions about these investment decisions.

**High codification condition:**

Experimenter: I have here depictions of factors that may be important in your decisions.

[Experimenter gives participants a set of five labeled figures]

Experimenter: Using these weighted arrows will you please use these depictions of factors to visually describe how you make investment decisions?

Participant: [Response.]

Experimenter: The thick arrows represent high importance, the thin represent low importance and the double headed arrows represent one factor depending on another.

Experimenter: [Once a model is developed.] Using this visual model, will you talk me through three of the profiles that you previously scored? [This is done for each of the three profiles]. Is there anything that needs to be changed?

**Low codification condition**

Experimenter: I am interested in how your decisions relate to your firm. I have here depictions of the potential aspects/levels of firm structure.

[Experimenter gives participants pictures that represent functional and divisional structure.]

Using these weighted arrows—thick representing high importance, thin representing low importance, the two-way arrows describing joint decisions and no arrows suggesting that a particular aspect/level is not important—will you please visually describe who in your firm has an important role in making decisions about whether or not to invest in an opportunity?

Participant: [Response.]

[If the participant is unwilling to use the pictorial representations of the variables to build a model, the experimenter can have the participant walk him through the building of the model.]

Experimenter: Do you mind if I take a picture of this? [Experimenter takes a picture of the model that was created and then responds.]

**High/promotion-  
focus incentive  
condition**

That is exactly right.

**High/prevention-  
focus incentive  
condition**

That is definitely not  
wrong.

**Low incentive  
condition**

[No response].

[Experimenter removes the visual depictions of the factors.]

Experimenter: Based on your evaluations of the hypothetical opportunities, will you please give an example of a decision in another area of your life that is *like* your decisions about opportunities—such as family decisions, political decisions or decisions about interests or hobbies that you may have—and then describe to me how this decision is similar to your opportunity evaluation decisions.]

Participant: [Response.]

[These responses are recorded and subsequently coded for use of structural analogical similarity between decisions using a nine point continuous scale anchored by high structural similarity (9) and low structural similarity (1).]

**High/promotion-  
focus incentive  
condition**

This is going well.

**High/prevention-  
focus incentive  
condition**

This isn't going badly.

**Low incentive  
condition**

[No response].

Experimenter: The third part of the study involves *another* set of opportunity evaluation decisions. The process for doing this is the same as in the first part of the study.

[Experimenter places a computer in front of the participant.]

Experimenter: Please let me know once you are done with all the profiles.

Participant: [Response].

[Experimenter looks at the computer and then responds.]

**High/promotion-focus incentive condition**

This is going smoothly.

**High/prevention-focus incentive condition**

This isn't going poorly at all.

**Low incentive condition**

[No response].

**High/promotion-focus incentive condition**

Experimenter: Similar to the first activity, there are some additional questions to ask about your decisions. Based on the previous discussion of your decisions, it is important that you successfully report the factors that most closely represent your actual decisions. Again, this is the essential part of the study. Thank you for taking it so seriously.

**High/prevention-focus incentive condition**

Experimenter: Similar to the first activity, there are some additional questions to ask about your decisions. Based on the previous discussion of your decisions, it is important that you do not mistakenly report the factors that don't most closely represent your actual decisions. Again, this is the critical part of the study. Thank you.

**Low incentive condition**

Experimenter: Similar to the first activity, there are some additional questions to ask about your decisions.

[Experimenter refers to the first page of Evaluation Form B and verbally asks the participant the questions on the form.]

Participant: [Response.]

Experimenter: To wrap up, I would like to ask some follow-up questions about yourself and your industry that relate to opportunity evaluation. While you do this, I will calculate the results of your decision to show you before I go. Please let me know when you are done.

[Experimenter removes computer and calculates the results.]

[Experimenter then discusses the experiment with the participant and answers any questions that he or she may have and thanks them for their participation.]

## APPENDIX D – Analogy Coding Instructions

### Overview

In this study, participants were asked to make a decision about whether or not to invest in fully exploiting a potential opportunity based on a combination of four factors—potential value, knowledge relatedness, window of opportunity availability and number of potential opportunities (see appendix for definitions)—each of which was varied at two levels. The purpose of this coding exercise is to quantify the degree to which participants utilized analogy in their verbal responses to the following question:

Can you give an example of a decision in another area of your life that might be like your decisions about opportunities, whether it's a family decision, political decision or decision about hobbies or interests; and then describe how it's similar to your decisions about opportunities?

Verbal responses will be coded based on the surface similarity and structural similarity between the two decisions. To assist in understanding these two different types of similarity, I include an example of comparison based on the work of Gentner (1983) and—using the example to explain the terminology—describe her theoretical framework on structure-mapping to provide a context for coding participants' responses for both surface similarity and structural similarity.

### Comparison Example – Rutherford Analogy

At the center of our solar system is the sun. The sun is hot, yellow and massive. A number of planets revolve around the sun. The sun is more massive than these planets and is hotter than these planets. The sun attracts the planets that revolve around it, and the planets that revolve around the sun attract it (although to a lesser degree). These planets also attract each other.

The atom is like the solar system. At the center of the atom is a nucleus. A number of electrons revolve around the nucleus. The nucleus is more massive than the electrons. The nucleus attracts the electrons that revolve around it, and the electrons that revolve around the nucleus attract it (although to a lesser degree).

### Terminology

A number of terms will help in understanding the two types of similarities that are potentially important to comparison (Gentner, 1983). These terms are included below, and refer to the above analogy for clarification.

*Domain:* A system of objects, object-attributes and relations between objects (p. 156). *Example:* The solar system is a system of objects, that has specific attributes and relationships between the objects.

*Analogy:* An assertion that a relational structure that normally applies in one domain can be applied in another domain (p 156). *Example:* The

structure of the relationships between the objects that make up our solar system can apply to the structure of the relationships between the objects that make up the atom.

*Object attribute:* A predicate taking one argument (p. 157). *Example:* The sun is hot, yellow, and massive.

*Relationships between objects:* Predicates taking two or more arguments (p. 157). *Example:* Planets revolve around the sun.

*Target:* The domain being explicated (p. 157). *Example:* The atom.

*Base:* The domain that serves as the source of knowledge (p. 157).

*Example:* The solar system.

*Surface similarity:* Similarity of object-attributes from target to base.

*Example:* The nucleus of an atom is yellow, just like the sun is yellow (not true, of course).

*Structural similarity:* Similarity of relationships between objects from target to base. *Example:* Electrons revolve around the nucleus of an atom just like planets revolve around the sun.

### Types of Similarity and Comparisons

According to Genter (1983), not all comparisons are analogies. Other types of comparisons also exist. Comparisons can be characterized by the type of similarities. In the 2X2 matrix below, four types of comparison are shown.

		<b>Surface Similarity</b>	
		<i>Many</i>	<i>Few</i>
<b>Structural Similarity</b>	<i>Many</i>	I. Literal Similarity	II. Analogy
	<i>Few</i>	III. Mere Appearance Match	IV. Anomaly

Box I describes a literal similarity. Using the solar system as the base, a comparison with a target that involves literal similarity is: the K5 solar system is like our solar system. In this example, there are many surface similarities (e.g., attributes: both have a massive sun), and many structural similarities (e.g., relationships: both have planets that revolve around the sun).

Box II describes an analogy. In the Rutherford above analogy, there are few surface similarities (e.g., attributes: sun is yellow while the nucleus is not), but many structural similarities (e.g., relationships: planets revolve around sun and electrons revolve around nucleus).

Box III describes a mere appearance match. Using the solar system as the base, a mere appearance match is: the school bus that has been in a parking lot for



many hours on a bright summer day is like our solar system. In this example, there are many surface similarities (e.g., attributes: the sun is hot and the school bus is hot), but few structural similarities (e.g., relationships: planets revolve around the sun while nothing revolves around a school bus).

Box IV describes an anomaly. Using the solar system as the base, an anomaly is: milk is like the solar system. In this example, there are few surface similarities (e.g., attributes: the sun is yellow, milk is not yellow), and few structural similarities (e.g., relationships: planets revolve around the sun while nothing revolves around milk).

### **Coding the Responses**

In the case of the current study comparing an individual's opportunity investment decision policy to a decision in another area of their life that might be like their decisions about opportunities, their investment decision policy is the base and their response the target. After viewing the breakdown of significant factors in a participant's actual decisions, and the direction of the significant effects, you will read a transcript of their verbal response and assign a score between 1 and 7 for both surface similarity (1 being few object-attributes and 7 being many object-attributes) and structural similarity (1 being few relationships between objects and 7 being many relationships between objects). You will also assign an overall score as to whether the comparison displays more surface similarity (-3) or more structural similarity (3).

#### *Surface Similarity Guide*

The participants are asked, based on combination of the four factors: how they would rate the likelihood that they would invest in fully exploiting a potential opportunity? In this decision context, surface similarity is based on four primary object-attributes inherent in the decision to invest in the opportunity. It involves:

1. A business opportunity (i.e., profit seeking);
2. A significant monetary investment;
3. An investment of time and effort; and
4. The full-scale exploitation of the opportunity.

Thus, ratings for surface similarity would be:

- High (7) if the target decision contained all four of the above object-attributes;
- High-Medium (4 to 6) if the target decision contained two or three of the above object-attributes;
- Low-Medium (2 to 4) if the target decision contained one or two of the above object-attributes; and
- Low (1) if the target decision contained none of the above object-attributes.

### *Structural Similarity Guide*

As is noted previously, participants are asked to make decisions to invest in fully exploiting a potential opportunity based on the combination of four factors, each varied at two levels. In this decision context, structural similarity is based on the relationship between the decision to invest and the factors that are used in that decision to invest. These can be seen from each participant's breakdown (by percentage and sign) of significant factors, for both main and interaction effects.

Thus, ratings for structural similarity would be:

- High (7) if the target decision was related to 80-100% of the decision factors/decision factor interactions;
- High-Medium (4 to 6) if the target decision was related to 50-80% of the decision factors/decision factor interactions; and
- Low-Medium (2 to 4) if the target decision was related to 20-50% of the decision factors/decision factor interactions; and
- Low (1) if the target decision was related to none of the decision factors/decision factor interactions.

### *Combination Rating Guide*

This final question is whether surface similarity is utilized more in the comparison or whether structural similarity is utilized more in the comparison. In this decision context, ratings of overall similarity are based on the overarching nature (structural as opposed to surface) of the comparisons from the target to the base.

Thus, ratings for the overall similarity would be:

- High (3) when most, if not all, of the comparison of the target to the base is anchored in structural similarity;
- High-Neutral (1 to 2) when more than half, but not all, of the comparison of the target to the base is anchored in structural similarity;
- Neutral (0) when the comparison of the target to the base is equally anchored in (or not anchored in<sup>28</sup>) structural similarity and surface similarity;
- Low-Neutral (-1 to -2) when more than half, but not all, of the comparison of the target to the base is anchored in surface similarity;
- Low (-3) when most, if not all, of the comparison of the target to the base is anchored in structural similarity;

### **Example**

On the following pages, there is a coding example to illustrate the coding process. The top of the page contains the breakdown (by percentage and sign) of significant factors and a place to make notes on the base decision. Below this, there is a place to give ratings for both types of similarity. Additionally, there is a

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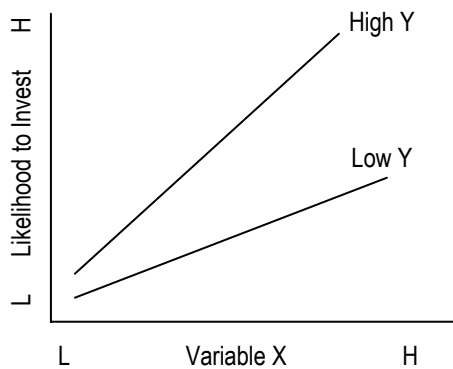
<sup>28</sup> When a comparison contains neither surface nor structural similarity.

space to make notes about the reasons for assigning the score. This is then followed by the text of the target decision. Sample scores have been assigned and reasons given for the target example, relative to the base (an actual example from pre-testing).

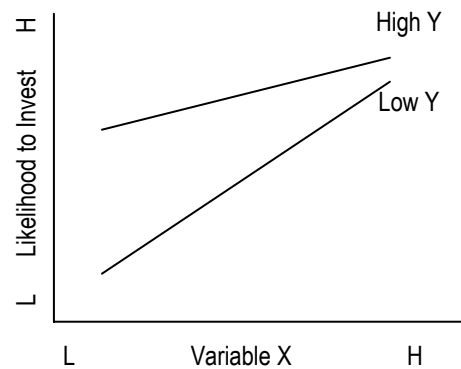
Additionally, to help in understanding any interactions that might be part of the base decision that is used in the comparisons, the following figures depict the nature of the most likely interactions (both positive and negative) for these decisions.

### *Interactions*

*Positive Interaction*



*Negative Interaction*



## References:

Gentner, D. 1983. Structure-mapping: A theoretical framework for analogy. *Cognitive Science*, 7(2): 155-170.

Case #: PRACTICE

Coder #: PRACTICE

Variable	%	+/-	Notes:
Value (V)	39.7	+	High value and knowledge seem to be the most important. Having a few opportunities is also important. And, least important is a wide window of opportunity (although it still plays a role). No interactions.
Knowledge (K)	32.8	+	
Window (W)	12.1	+	
Number (N)	15.4	-	
V*K			
V*W			
V*N			
K*W			
K*N			
W*N			
V*K or W*N			
V*W or K*N			
V*N or K*W			

<b>Similarity Ratings</b>									
<b>Surface</b>	1	2	3	4	5	6	7	<b>Notes</b> :	The marriage decision involves an investment of time and effort, but (as is explained by the participant) is not profit seeking and is not just exploitation of an opportunity.
<b>Structural</b>	1	2	3	4	5	6	7	<b>Notes</b> :	Used knowledge (compatibility), profitability (emotional and social stability), and referenced window of opportunity as less important in the decision. Did not reference number of potential opportunity, while it was while it was still used.
<b>Surface</b>	-3	-2	-1	0	1	2	3	<b>Structural</b> <b>Notes</b> :	This seems to have more structural aspects than non-structural aspects, but also seems to reference the business decision.

### **PRACTICE Analogy Answer**

Experimenter:	So based on your evaluations of the hypothetical opportunities, will you give me an example of a decision in another area of your life that is like your decisions about opportunities; whether it be family decisions, political decisions, decisions about sports, hobbies, interests; and then describe to me how this is similar to your opportunity evaluation decisions.
Participant:	OK. I guess it's easiest to stop, start with the example...
Experimenter:	OK.
Participant:	...say, for example, marriage. Maybe, maybe that's an example used a lot, I don't know. But, uh, you know, you don't want to marry someone with whom you're incompatible. Just as you don't want to pursue that you don't have the resources, capabilities to actually pursue. It'll just make things a whole lot more difficult if you're not a good match in the first place. Um, let's see, uh. Obviously, um, you know, this doesn't work so well with marriage, but an important criteria is the, um, profitability. Um, marriage isn't really profitable. But um, you know, when you're making a decision to do something you want it to be profitable for you. Whether or not that's money or not. You know, maybe marriage is profitable if you're not considering the money aspect, but whether the, but instead the emotional or social stability that comes from it. That could be the profit from that. Um, other than that, you know, those to me are the two most important pieces of making a decision. Is whether it fits with the person I am or the company that we are and whether it's going to be beneficial to me or the company? Um, besides that, I think that, um, you know, the things that were listed, so like window of opportunity, maybe not as important.

## APPENDIX E – Espoused Decision Policy Measurement Script

1. When assessing the previous profiles, what things did **you** consider when making your investment decisions?

- ☐ Potential Value of an Opportunity
- ☐ Knowledge Relatedness of an Opportunity
- ☐ Window of Opportunity Availability
- ☐ Number of Potential Opportunities
- ☐ Effect of \_\_\_\_\_ on \_\_\_\_\_
- ☐ Effect of \_\_\_\_\_ on \_\_\_\_\_
- ☐ Effect of \_\_\_\_\_ on \_\_\_\_\_
- ☐ Effect of \_\_\_\_\_ on \_\_\_\_\_

2. Are you more likely to invest when:

- a. Potential Value of Opportunity is: ☐ Higher ☐ Lower ☐ Not Important
- b. Knowledge Relatedness of Opportunity is: ☐ High ☐ Low ☐ Not Important
- c. Window of Opportunity Availability is: ☐ Wide ☐ Narrow ☐ Not Important
- d. Number of Potential Opportunities: ☐ Many ☐ Few ☐ Not Important

3. A. Is having high/higher/wide/many \_\_\_\_\_:

- ☐ MORE important OR ☐ LESS important when  
\_\_\_\_\_ is high/higher/wide/many?

B. Is having high/higher/wide/many \_\_\_\_\_:

- ☐ MORE important OR ☐ LESS important when  
\_\_\_\_\_ is high/higher/wide/many?

C. Is having high/higher/wide/many \_\_\_\_\_:

- ☐ MORE important OR ☐ LESS important when  
\_\_\_\_\_ is high/higher/wide/many?

D. Is having high/higher/wide/many \_\_\_\_\_:

- ☐ MORE important OR ☐ LESS important when  
\_\_\_\_\_ is high/higher/wide/many?

4. Please assign a score between 0 and 100 for each of the factors ***you*** use in your decisions based on its importance to your decisions:
- a. Potential Value of an Opportunity: \_\_\_\_\_
  - b. Knowledge Relatedness of an Opportunity: \_\_\_\_\_
  - c. Window of Opportunity Availability: \_\_\_\_\_
  - d. Number of Potential Opportunities: \_\_\_\_\_
  - e. Effect of \_\_\_\_\_ on \_\_\_\_\_: \_\_\_\_\_
  - f. Effect of \_\_\_\_\_ on \_\_\_\_\_: \_\_\_\_\_
  - g. Effect of \_\_\_\_\_ on \_\_\_\_\_: \_\_\_\_\_
  - h. Effect of \_\_\_\_\_ on \_\_\_\_\_: \_\_\_\_\_

## APPENDIX F – Study Two Materials

### Appendix F1. Task Instructions

#### Instructions

##### Your Task

As the head of a company in a technology-related industry, you are ideally qualified to make decisions about whether or not to invest in potential opportunities. In this part of the study you will be asked to evaluate a series of hypothetical opportunities. Your task is to decide whether or not to invest in the full-scale exploitation of each opportunity. When making these decisions assume that:

- *Other than the information provided in the profiles*, the hypothetical opportunities presented are assumed to be similar to other entrepreneurial opportunities you have “seen” in all respects;
- You have the resources (or access to the resources) to invest in an opportunity, if you choose to do so
- You are making decisions about these opportunities for your current firm; and
- You are making decisions about these opportunities in the current industry and economic environment.

I also ask that you consider each profile as a separate decision, independent of all the others—please do not refer back to profiles already completed.

For each and every profile, refer to the definitions on the following page and use your expertise to make the requested decision.

#### Important Notes

It is important that you respond to all questions as incomplete surveys cannot be included in the statistical analyses.

Again, please be assured that your individual responses will remain anonymous and completely confidential. No reference will be made, in any report or publication, to individual responses in a way that would enable the identification of any respondent.



## Appendix F2. Description of Terms used in Task

### DESCRIPTION OF TERMS

Please detach this sheet and refer to it as you complete the task

#### Knowledge Relatedness of an Opportunity

<b><u>High</u></b>	The knowledge that is necessary to exploit this potential opportunity is <i>very similar</i> to the knowledge that you already possess.
<b><u>Low</u></b>	The knowledge that is necessary to exploit this potential opportunity is <i>very different</i> from the knowledge that you already possess.

#### Potential Value of an Opportunity

<b><u>Higher</u></b>	The predicted profit from investment in the full-scale exploitation of this potential opportunity is <i>higher</i> than other opportunities you have successfully pursued after the predicted expenses (i.e., time, money and effort) have been taken into account.
<b><u>Lower</u></b>	The predicted profit from investment in the full-scale exploitation of this potential opportunity is <i>lower</i> than other opportunities you have successfully pursued after the predicted expenses (i.e., time, money and effort) have been taken into account.

#### Window of Opportunity Availability

<b><u>Wide</u></b>	The next six months are free from changing conditions in the environment that will considerably shorten the length of time available to profitably invest in this potential opportunity.
<b><u>Narrow</u></b>	The next six months will bring about changes in the environment that will considerably shorten the length of time available to profitably invest in this potential opportunity.

#### Number of Potential Opportunities

<b><u>Many</u></b>	There are <i>several</i> potential opportunities with unknown potential value, knowledge relatedness and opportunity windows that you could choose to invest in and exploit.
<b><u>Few</u></b>	There is <i>one</i> potential opportunity that you could choose to invest in and exploit, the potential value, knowledge relatedness and opportunity windows of which are given in the opportunity profile.

**Appendix F3. Task Practice Profile**

**PRACTICE PROFILE: OPPORTUNITY XTU**

- |   |                 |
|---|-----------------|
| <b>1. Knowledge Relatedness of an Opportunity</b> | - <u>high</u>   |
| <b>2. Potential Value of an Opportunity</b>       | - <u>higher</u> |
| <b>3. Window of Opportunity Availability</b>      | - <u>narrow</u> |
| <b>4. Number of Potential Opportunities</b>       | - <u>many</u>   |

**Likelihood of Commitment**

Based on the above opportunity attributes, how would you rate the likelihood that you would invest in fully exploiting this potential opportunity?  
(Circle the number that best represents your response)

Very  
Unlikely to  
Invest in this  
Potential  
Opportunity

1

2

3

4

5

6

7

8

9

Very  
Likely to  
Invest in this  
Potential  
Opportunity

## APPENDIX G – Post-Experiment Questionnaire

### Part 1. Questions about this task

#### 1. Please answer the following questions about this task:

In this activity I was more concerned with:	Avoiding mistakes	1					7	Getting it right
In this activity, I was more interested in:	Thwarting negative outcomes							Attaining positive outcomes
In this activity, I was more concerned about:	Investing in a potential opportunity that turns out not to be a good one (a false opportunity)							Not investing in an opportunity that turns out to be a good one (a missed opportunity)
In this activity, I kept thinking about:	Eluding poor performance							Achieving excellent performance
How much effort did you put in trying to understand the way that you make decisions?	Minimal							Considerable
How motivated were you to take part in this research?	Not very							Very
How much effort did you put in making decisions about hypothetical opportunities?	Minimal							Considerable
How important was this activity?	Not very							Very

### Part 2. Questions about your business your business environment

#### 2. Please answer the following:

How many reasonably well defined potential opportunities would you estimate that you have identified in the past?	_____
How many of these opportunities did you actually pursue?	_____
	Not at all Important 1      7 Very Important
How important is pursuing new opportunities in your current industry?	
How important are intuitive feelings in decisions about opportunities?	

#### 3. Please answer the following questions for your principal industry (the industry that accounts for the largest % of your sales), by selecting the number in each scale that best approximates the actual conditions in it.

	Strongly Disagree 1      Neutral      Strongly Agree 7
My business unit must rarely change its marketing practices to keep up with competitors.	
The rate at which products are becoming obsolete in my industry is very slow.	

	Strongly Disagree 1		Neutral		Strongly Agree 7
Actions of competitors are quite easy to predict.					
The set of competitors in my industry has remained relatively constant over the last 3 years.					
Product demand is easy to forecast.					
Customer requirements/preferences are easy to forecast.					
My industry is characterized by very little cyclical or other periodic business fluctuations.					
My industry is very stable with very little change resulting from major economic, technological, social, or political forces.					
The failure rate of firms in my industry is high.					
My industry is very risky, such that one bad decision could easily threaten the viability of my business unit.					
Competitive intensity is high in my industry.					
Customer loyalty is low in my industry.					
Attractive investment and market opportunities are scarce in my industry.					
Severe price wars are characteristic of my industry.					
Low profit margins are characteristic of my industry.					

#### 4. Additional Information

When was the firm you are associated with founded?	____ (year)
Is the firm you are associated with:	<input type="checkbox"/> Independent <input type="checkbox"/> A subsidiary of another firm
Approximately how many full-time employees (or full-time equivalent) does your firm have today, including owners who work for the company)?	____ (employees)
Approximately how large do you expect your total sales to be this year?	____ (dollars)

### Part 3. Questions about yourself

5. Please answer the following:	Strongly Disagree 1		Neutral		Strongly Agree 7
I will be able to achieve most of the goals that I have set for myself.					
When facing difficult tasks, I am certain that I will accomplish them.					
In general, I think that I can obtain outcomes that are important to me.					
I believe I can succeed at most any endeavor to which I set my mind.					
I will be able to successfully overcome many challenges.					
I am confident that I can perform effectively on many different tasks.					
Compared to other people, I can do most tasks very well.					
Even when things are tough, I can perform quite well.					
I am able to select opportunities that are most likely to be profitable.					
I have a knack for pursuing the right opportunities.					
I have the necessary abilities to make an investment succeed.					
I am good at developing new products or services.					
I am able to gain access to the resources necessary to successfully exploit an opportunity.					
I am good at knowing who the right people are to help implement a new product or service.					
I am able to overcome the challenges associated with pursuing a new product or service.					
I can make an investment succeed in the face of uncertainty.					

6. Please answer the following about your general attitudes towards failure:	Do not Believe at All 1	Believe 50% of the Time	Believe 100% of the Time 7
When I am failing, it is often because I am not smart enough to perform successfully.			
When I am failing, my future seems uncertain.			
When I am failing, it upsets important others.			
When I am failing, I blame my lack of talent.			
When I am failing, I believe that my future plans will change.			
When I am failing, I expect to be criticized by important others.			
When I am failing, I am afraid that I might not have enough talent.			
When I am failing, it upsets my "plan" for the future.			
When I am failing, I lose the trust of people who are important to me.			
When I am not succeeding, I am less valuable than when I succeed.			
When I am not succeeding, people are less interested in me.			
When I am failing, I am worried about it affecting my future plans.			
When I am not succeeding, people seem to want to help me less.			
When I am failing, important others are not happy.			
When I am not succeeding, I get down on myself easily.			
When I am failing, I hate the fact that I am not in control of the outcome.			
When I am not succeeding, people tend to leave me alone.			
When I am failing, it is embarrassing if others are there to see it.			
When I am failing, important others are disappointed.			
When I am failing, I believe that everybody knows I am failing.			

	Do not Believe at All 1		Believe 50% of the Time		Believe 100% of the 7
When I am not succeeding, some people are not interested in me anymore.					
When I am failing, I believe that my doubters feel that they were right about me.					
When I am not succeeding, my value decreases for some people.					
When I am failing, I worry about what others think about me.					
When I am failing, I worry that others may think I am not trying.					
<b>7. Please answer the following questions about your thinking:</b>	Not very much like me				Very much like me
I think of several ways to solve a problem and choose the best one.					
I challenge my own assumptions about a task before I begin.					
I think about how others may react to my actions.					
I find myself automatically employing strategies that have worked in the past.					
I think about what I really need to accomplish before I begin a task.					
I perform best when I already have knowledge of the task.					
I use different strategies depending on the situation.					
I create my own examples to make information more meaningful.					
I try to use strategies that have worked in the past.					
I ask myself questions about the task before I begin.					
I try to translate new information into my own words.					
I organize my time to best accomplish my goals.					
I am good at organizing information.					

	Not very much like me				Very much like me
I try to break problems down into smaller components.					
I know what kind of information is most important to consider when faced with a problem.					
I consciously focus my attention on important information.					
My 'gut' tells me when a given strategy I use will be most effective.					
I depend on my intuition to help me formulate strategies.					
I focus on the meaning and significance of new information.					

#### Part 4. Personal Information (will be kept confidential)

##### 8. Work Experience

What is your total years full-time work experience?	____ (years)
How many of these years have been in the same industry as your firm's current primary industry?	____ (years)
How many of these years have been in a different (but similar) industry to your firm's current primary industry?	____ (years)
Are you the (or one of the) principal founder(s) of your current firm?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Have you been directly involved in the starting up of other firms?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If yes, how many start ups?	____

##### 9. Education

What is the highest level of formal education completed?	
<input type="checkbox"/> Some high school	<input type="checkbox"/> High school diploma
<input type="checkbox"/> Bachelors degree	<input type="checkbox"/> Some graduate study
<input type="checkbox"/> Some university/college	<input type="checkbox"/> Masters Degree
<input type="checkbox"/> Associate degree	<input type="checkbox"/> Doctoral Degree
What is the education major of the highest level of formal education you completed?	
<input type="checkbox"/> Business <input type="checkbox"/> Law <input type="checkbox"/> Science <input type="checkbox"/> Engineering <input type="checkbox"/> Arts/Humanities <input type="checkbox"/> Other: _____	



---

**10. Gender** ☐ Male ☐ Female

---

**11. Age** \_\_\_\_\_ (years)

---

**12. Please answer the following Business Trivia Questions:**

---

According to the U.S. Census, approximately how many business establishments (single physical locations where business is conducted or where services or industrial operations are performed) were in operation in the United States in 2002?

☐ 2,500,000 ☐ 5,000,000 ☐ 7,500,000 ☐ 10,000,000 ☐ 12,500,000

Please indicate, on a scale ranging from 20% to 100%, your confidence in your answer (20% confidence is pure chance, 100% confidence is absolute certainty). \_\_\_\_\_ (percent)

---

Approximately how many patents were awarded by the US Patent and Trademark Office in 2004?

☐ 78,000 ☐ 187,000 ☐ 329,000 ☐ 462,000 ☐ 735,000

Please indicate, on a scale ranging from 20% to 100%, your confidence in your answer (20% confidence is pure chance, 100% confidence is absolute certainty). \_\_\_\_\_ (percent)

---

For the period 2001-2002 how many establishment deaths (establishments that ceased all operations) occurred in the United States?

☐ 134,565 ☐ 357,630 ☐ 586,890 ☐ 849,525 ☐ 1,098,405

Please indicate, on a scale ranging from 20% to 100%, your confidence in your answer (20% confidence is pure chance, 100% confidence is absolute certainty). \_\_\_\_\_ (percent)

---

What was the approximate average exchange rate of the Canadian Dollar per 1 U.S. Dollar in 1974?

☐ 0.85 ☐ 0.95 ☐ 1.05 ☐ 1.15 ☐ 1.25

Please indicate, on a scale ranging from 20% to 100%, your confidence in your answer (20% confidence is pure chance, 100% confidence is absolute certainty). \_\_\_\_\_ (percent)

---

The cancellation of the 2004-2005 National Hockey League (NHL) season cost approximately how much in revenue?

☐ 100 Million ☐ 200 Million ☐ 300 Million ☐ 400 Million ☐ 500 Million

Please indicate, on a scale ranging from 20% to 100%, your confidence in your answer (20% confidence is pure chance, 100% confidence is absolute certainty). \_\_\_\_\_ (percent)

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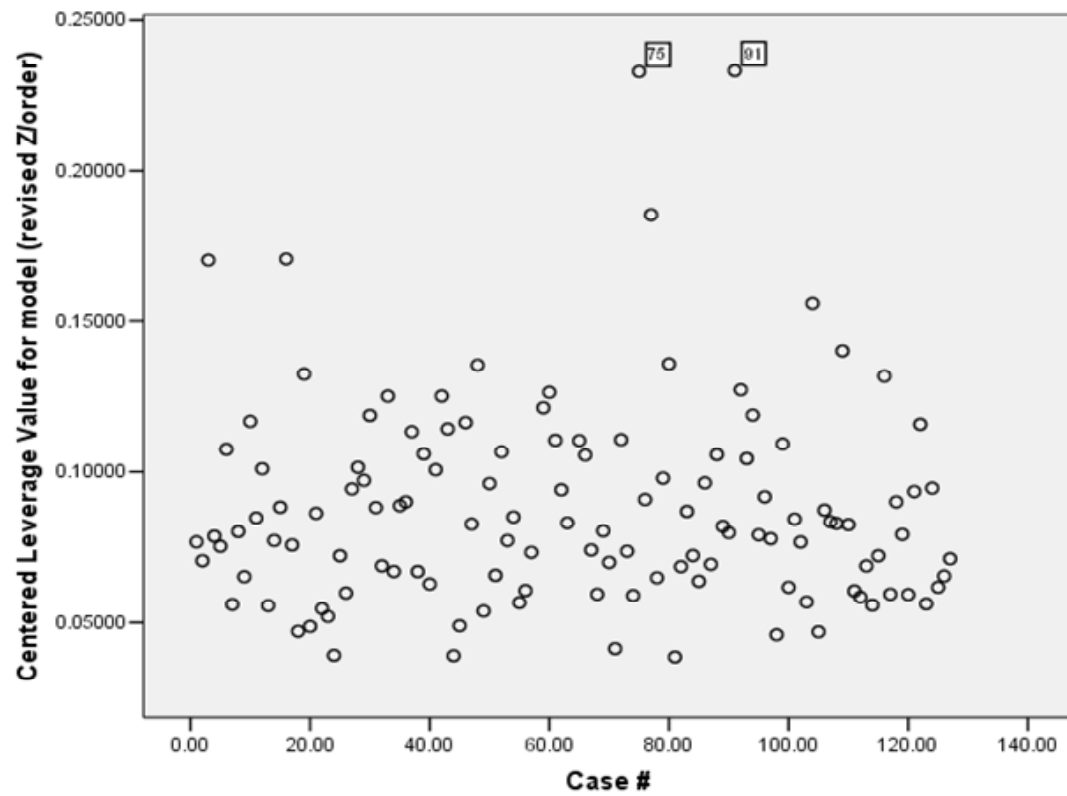
**13. Have you experienced a previous business failure?** ☐ Yes ☐ No

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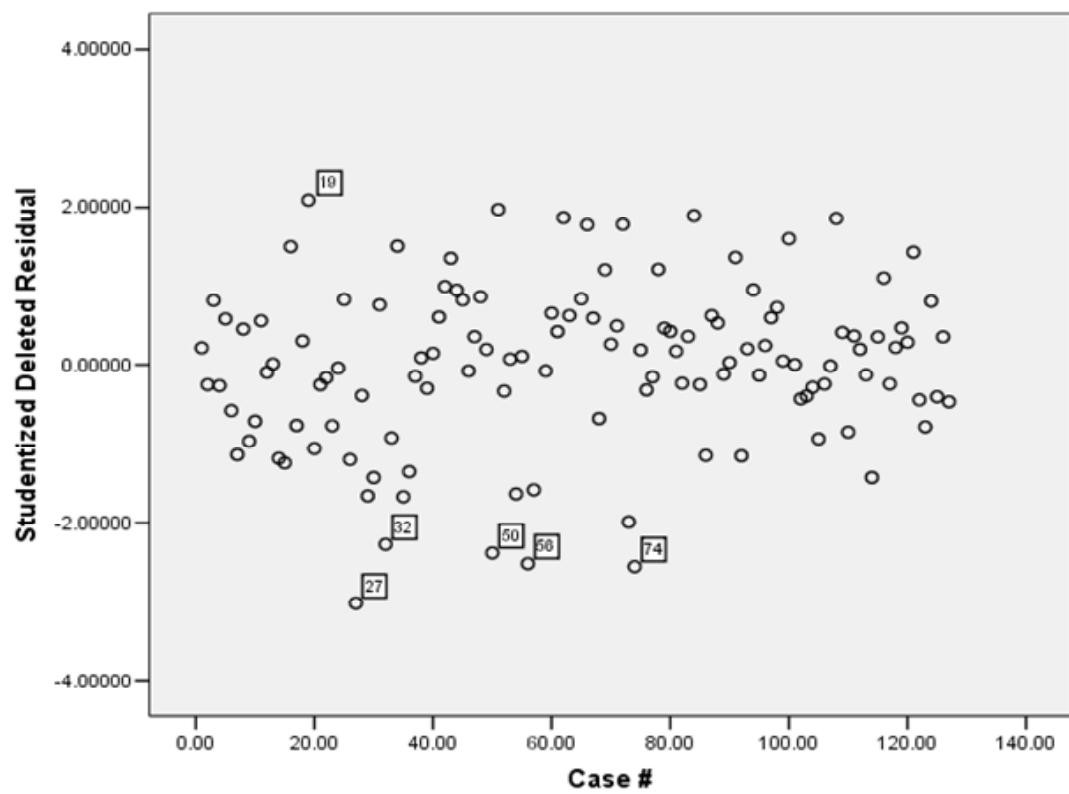
**Thank you!**

## APPENDIX H – Regression Diagnostics

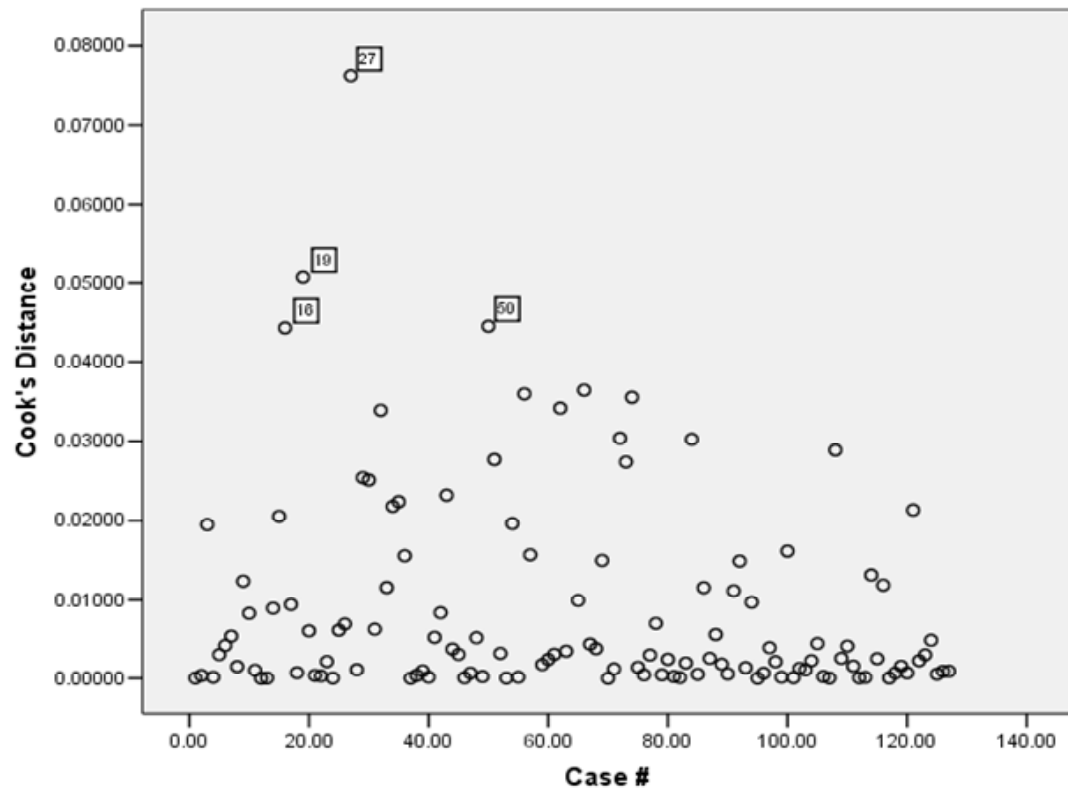
### Appendix H1. Centered Leverage Value Index Plot



## Appendix H2. Externally Studentized Residuals Index Plot

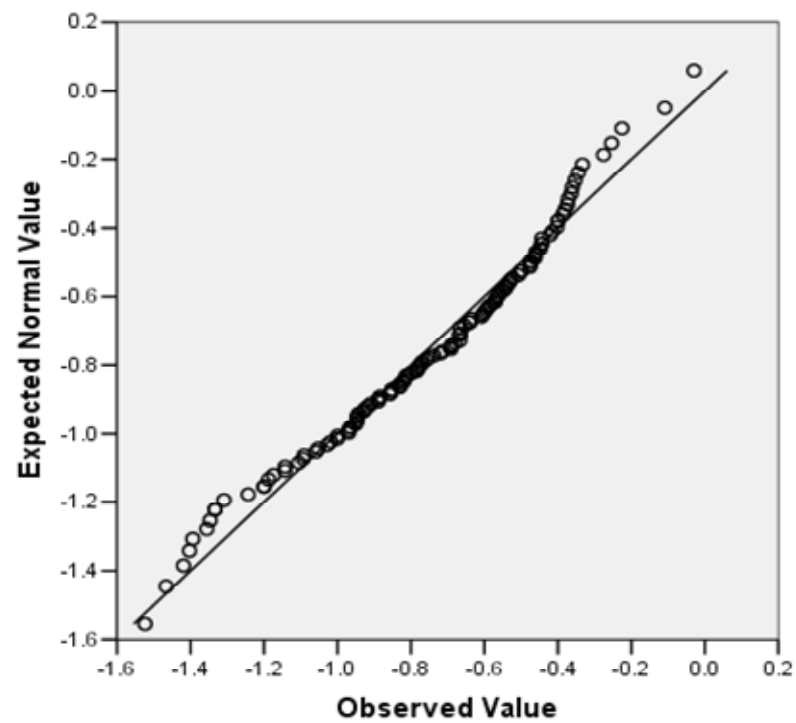


### Appendix H3. Cook's D Index Plot



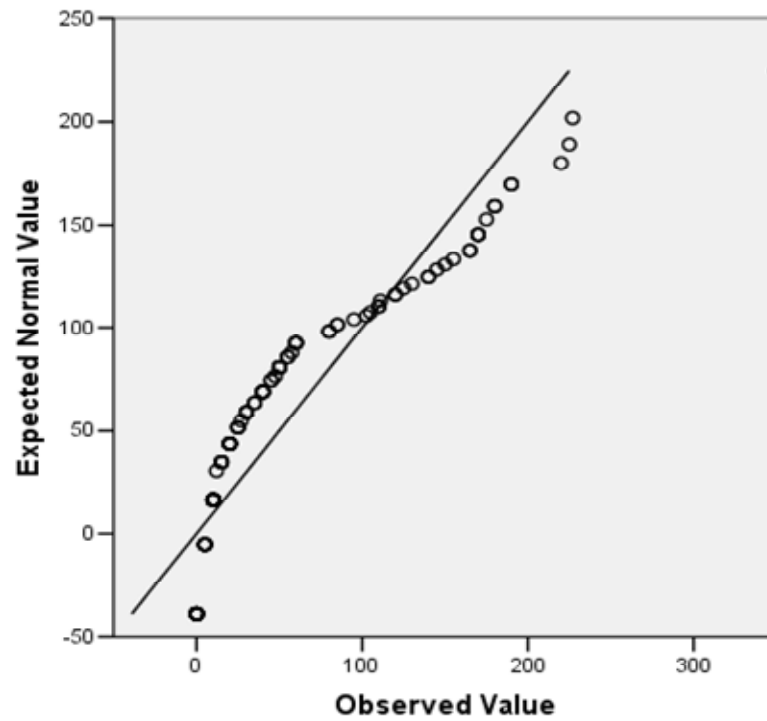
#### Appendix H4. Q-Q Plot: Decision-Policy Consciousness

Normal Q-Q Plot of Control\_Time 1 Decision Policy Consciousness (Cont



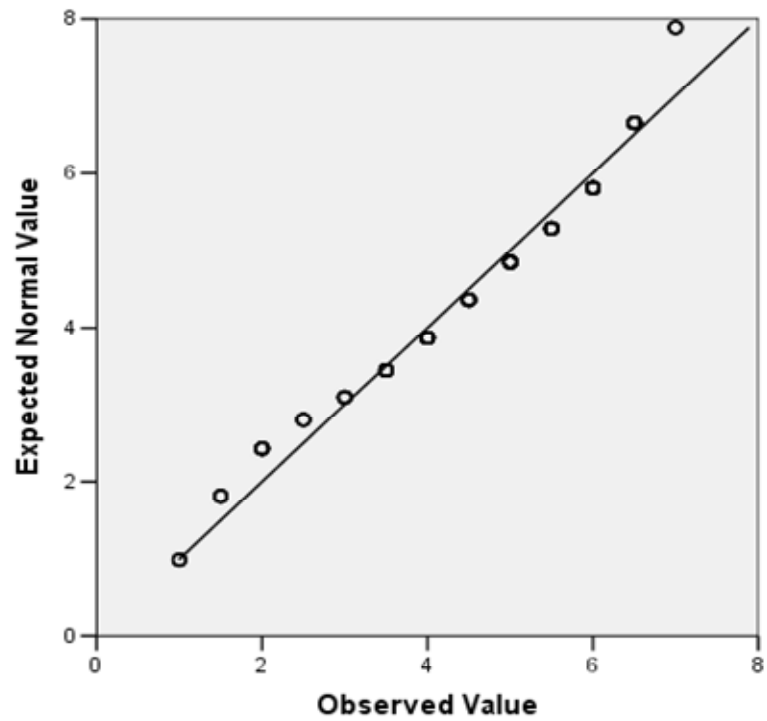
## Appendix H5. Q-Q Plot: Change in Espoused Prior to Transformation

Normal Q-Q Plot of Change in Espoused Raw Score

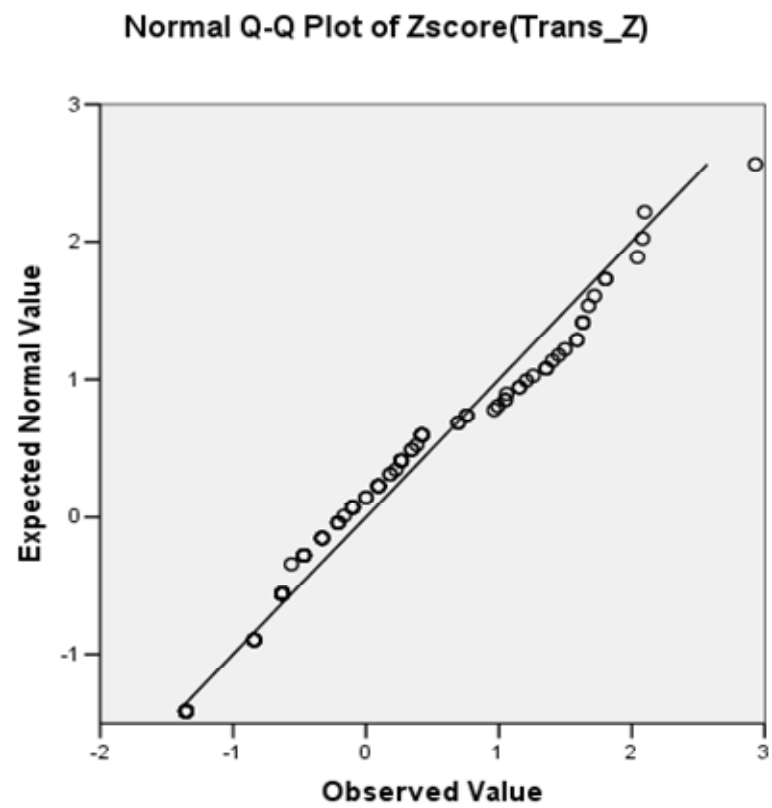


## Appendix H6. Q-Q Plot: Structural Similarity of Analogy

Normal Q-Q Plot of Structural Similarity of Analogy



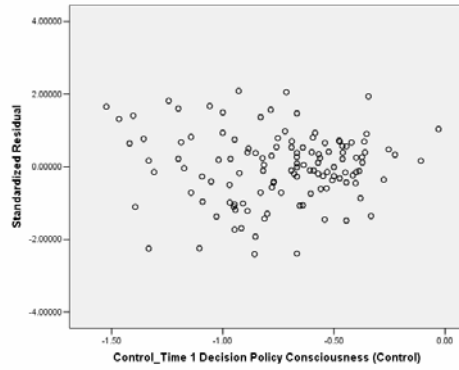
**Appendix H7. Q-Q Plot: Change in Espoused Following Transformation**



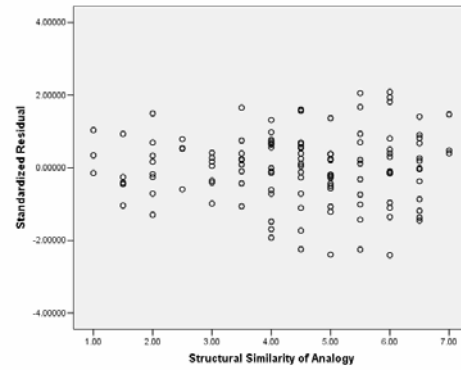


## Appendix H8. Studentized Residuals and Independent Variables

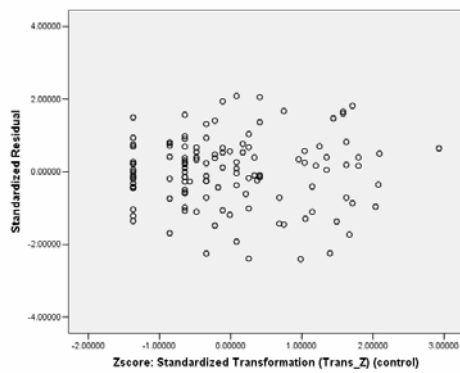
Decision-Policy Consciousness:  
Time 1



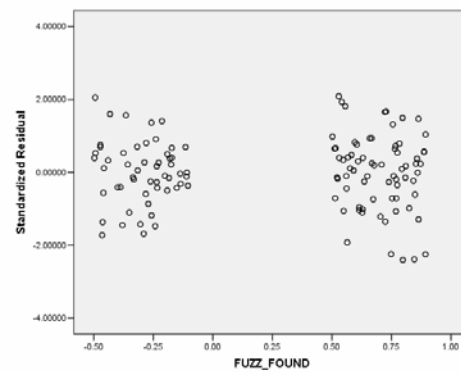
Structural Similarity



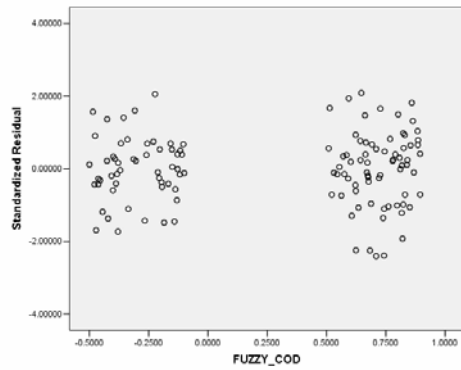
Expoused Change  
(Transformed)



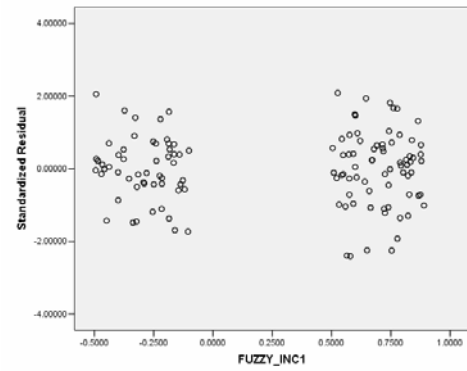
Founder Status  
(Fuzzy)



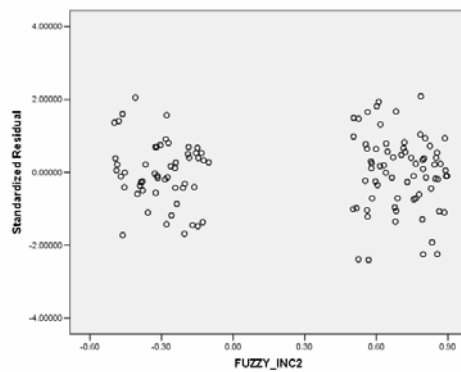
**Codification Contrast  
(Fuzzy)**



**Incentive Contrast: High v. Low  
(Fuzzy)**



**Incentive Contrast: Gain/Loss  
(Fuzzy)**



## VITA

NAME: John Robert Mitchell

BORN:

DEGREES:

B.I.S. Weber State University, 2001

Ph.D. Indiana University, 2006